4.1 SYSTEM SAFETY AND RELIABILITY

This section describes and assesses the system safety, reliability, and hazardous materials associated with both current and proposed operations at the Chevron El Segundo Marine Terminal. System safety and reliability includes issues such as fires, explosions, and oil and product spills from the Marine Terminal (both the onshore portion and the offshore pipelines and berths) and from vessels that visit the Marine Terminal. This section analyzes impacts from the proposed Project and its principal alternatives. Cumulative impacts from this and other projects in the region are also evaluated. Where significant impacts are identified, mitigation measures are recommended to improve response planning and reduce event frequency and size.

Potential soil, marine sediment, and ground water contamination by hazardous materials associated with the proposed Project are also addressed in this section. Impacts to specific resources associated with the potential spills discussed in this section are detailed further in Section 4.2, Water and Sediment Quality; Section 4.3, Biological Resources; and Section 4.7, Land Use, Planning, and Recreation.

4.1.1 Environmental Setting

This subsection characterizes the baseline physical and chemical conditions around the Project site and throughout the greater Southern California Bight (SCB) that could influence an oil spill or discharge related to the proposed Project, or that have the potential to influence vessel safety. These conditions include natural phenomena such as currents, waves, tides, winds, and fog. Additional detailed data on surface, ground, and ocean waters; sediments; and wind patterns can be found in Section 4.2, Water and Sediment Quality, and Section 4.4, Air Quality.

Area activity related to vessel traffic in and out of nearby ports and harbors is also addressed in this subsection, along with response capabilities for both spills and safety emergencies, such as fires. The geographic areas and sensitive receptors that could be affected by a spill associated with current operations are also detailed, in addition to an analysis of historical spills.

Environmental Conditions

The proposed Project is located in the south-central portion of the Santa Monica Bay near the city of El Segundo, California. Santa Monica Bay is an integral part of the larger geographic region commonly known as the SCB that includes coastal southern

California, the Channel Islands, and the local portion of the Pacific Ocean. Santa Monica Bay is relatively shallow and is characterized by a gently sloping coastal shelf extending seaward approximately 11 miles (17.7 kilometers [km]) to a depth of approximately 328 feet (100 meters [m]). At this point, the sea floor steepens and rapidly falls off towards the floor of the Santa Monica Basin where depths reach approximately 0.5 to 0.56 miles (800 to 900 m) (HEDD 1990).

Bathymetric surveys conducted by Chevron indicate that, in the vicinity of the Marine Terminal moorings, the bottom of the bay is essentially a uniform sloping plain with minor rises and depressions (Fugro West, Inc. 2004). Water depths in the Berth 3 mooring areas range from 64 to 70 feet (19.5 to 21 m), with the sea floor gently sloping to the west-southwest at approximately six to seven feet (1.8 to 2.1 m) per 1,000 feet (305 m). A shallow depression, one to two feet deep (0.3 to 0.6 m), is located 200 feet (61 m) south of the Berth 3 pipeline end manifold (PLEM), which lies in 68 feet (21 m) of water (Fugro West, Inc. 2004).

Water depths in the Berth 4 mooring area range from 70 to 76 feet (21 to 23 m). Two seafloor depressions are located in the Berth 4 area. The first has a depth of approximately 12 feet (3.6 m) below the surrounding seafloor with the deepest point located 210 feet (64.0 m) southeast of the Berth 4 PLEM. The has a depth of 15 feet (4.6 m) below the surrounding seafloor and the deepest part is located southwest of berth 4 PLEM. Also, there is a 1 foot high east-west ridge just north of the PLEM and 74 feet deep vally, 1,000 feet southwest of PLEM. The PLEM is on the slope of a depression which is enlarged every year (Fugro West, Inc. 2004).

Currents and Tides

Oceanic flow in the Project area is dominated by the California Current, which carries seawater originating at higher latitudes southward along the California coast. The arctic origins of the California Current result in waters that are cooler and have lower salinity compared to other oceanic currents in the region. South of Point Conception, the bulk of the California Current generally remains well offshore, but regular shearing of the current into the SCB occurs, forming a series of eddies, including the persistent, large-scale Southern California eddy. The predominant near-shore, northward flow component (called the Southern California Countercurrent) of this eddy travels through the central SCB (from the Mexican border north to Point Conception), resulting in the general northerly flow regime observed in the Santa Monica Bay.

Tides in the Santa Monica Bay are mixed and semidiurnal, meaning a tide cycle is comprised of two unequal high and two unequal low tides each day. Tides vary with the phase of the moon. The tidal range, or difference between the highest and lowest tide levels, is greatest during spring tides when the moon is in line with the sun and their gravitational forces reinforce one another (new or full moon). The highest and lowest tides reported for the Bay are 7.96 feet (2.4 m) above mean lower low water (MLLW) level and 2.56 feet (0.8 m) below MLLW, respectively.

Local wind-generated waves in the area arrive predominantly from the west and southwest (see discussion of winds), but they can occur from all offshore directions throughout the year. Local waves average 3.7 feet (1.1 meters) in height, with wave periods of less than 10 seconds (between 2004 and 2008 at National Oceanic and Atmospheric Administration [NOAA] buoy 46221). The wave period is a measurement of the time between two consecutive wave peaks as they pass a stationary location. In contrast, maximum wave heights range up to 11.2 feet (3.4 meters) during the winter months. See Section 4.2, Water and Sediment Quality, for more discussion of waves and currents.

Winds and Weather

Prevailing winds within the SCB are west-northwesterly. Offshore, the Pacific high-pressure cell is the dominant influence on low-level wind flow in the region, particularly during the summer when it maintains almost constant northwesterly winds. During periods of prolonged northwesterly winds, nearshore surface waters are transported offshore and are replaced by cooler, deeper water in a phenomenon known as upwelling. Air closest to the sea surface becomes chilled and forms an inversion layer from 0.2 to 0.6 miles (0.3 to 1.0 km) above the surface. Moist, warm ocean air moving toward the coast is cooled first by the California Current, then by the even cooler upwelled waters. Cooled air over upwelling regions of the ocean often causes fog formation. Locally, during the late spring and early summer, the fog layer may deepen to several thousand feet, resulting in drizzle throughout the Coastal Plain. At Los Angeles International Airport, approximately two miles (3.2 km) north of the terminal, foggy conditions reduced visibility to less than 0.25 miles (0.4 km) on 26 days during 2008, or seven percent of the time (NOAA 2009).

As winter approaches, the Pacific high-pressure cell weakens and shifts to the south. This allows polar storm systems to pass through the region, producing strong shifting winds and periods of cloudiness and bringing much of the region's annual precipitation.

Average summer wind speeds are slightly higher than winter wind speeds. The dominant daily wind pattern is a daytime breeze from the sea and a nighttime breeze from land towards the sea. This pattern is broken only by occasional winter storms and infrequent strong southwestward Santa Ana winds due to high pressure cells over the desert that enter the coastal zone through mountain passes.

Typical summer daytime ocean wind speeds range from 10 to 15 miles per hour (mph) (17 to 25 kilometers per hour [km/h]), and seven to nine mph (12 to 15 km/h) for winter daytime winds. Westerly onshore winds, with speeds in the range of 12 to 18 mph (20 to 30 km/h), prevail in the Project area; however, maximum wind velocities of up to 60 mph (100 km/h) have been recorded at the Marine Terminal.

Area Vessel Activity

Vessels in the Project area are generally coming into or out of the Port of Los Angeles (POLA) or the Port of Long Beach (POLB). During 2007, approximately 5,200 commercial vessels (not including recreational or fishing vessels) arrived at the POLA and POLB. Many of these vessels pass through or near Santa Monica Bay en route to these ports, with the majority of vessels utilizing the designated Traffic Separation Scheme (Shipping) Lanes shown in Figure 2-1.

Table 4.1-1 presents commercial vessel arrivals at POLA and POLB by vessel type during 2007. Some of the vessels included in the data in Table 4.1-1 are associated with the movement of product from the Chevron Refinery to the POLA/POLB and to refineries and users in the area.

Of the total number of vessels arriving at the POLA/POLB, approximately 50 percent utilize the Traffic Separation Scheme Lanes to move to the north and west through the Santa Barbara Channel, while 35 percent use the Traffic Separation Scheme Lanes to the south of the ports. The remaining 15 percent of commercial vessel traffic accesses the ports from the north or west, outside (south) of the Channel Islands. Therefore, although close to 5,200 commercial vessels travel in the vicinity of Santa Monica Bay annually, the majority of this traffic remains within or near the Traffic Separation Scheme Lanes, which are at least 10 miles (16.1 km) away from the Marine Terminal.

Table 4.1-1
Number of Vessels Arriving at POLA and POLB During 2007

Vessel Type	POLA	POLB	Total
Auto Carrier	69	192	261
Bulk Cargo	140	236	376
Containers	1,575	1,358	2,933
Cruise	256	158	414
General Cargo	77	86	163
Ocean Tug	65	46	111
Miscellaneous	2	5	7
Reefer	47	2	49
Roll-on/Roll-off	1	102	103
Tanker	306	515	821
Total	2,538	2,700	5,238

Source: POLA 2008

Additional limited vessel activity in the Project area is associated with two recreational boating marinas located within a few miles of the Marine Terminal. To the north, the facilities at Marina Del Rey provide dock space for approximately 6,000 recreational vessels and 20 sport-fishing vessels. Six miles (9.7 km) south of the Marine Terminal, in Redondo Beach, King Harbor supports docking for approximately 1,400 recreational vessels and 20 sport-fishing vessels. In addition to the boats docked at these two harbors, vessels from other harbors within Los Angeles, Ventura, and Orange counties frequently transit the Santa Monica Bay on a regular basis. Additional information on recreational boating in the Project area is detailed in Section 4.9, Land Use, Planning, and Recreation.

Vessel Traffic Information Service Position Reporting Requirements

California regulations require all commercial vessels within 20 miles (32.2. km) of Point Fermin (just east of Point Vicente) to report their location by very high frequency (VHF) radio to the Vessel Traffic Information System (VTIS). The Marine Exchange of Los Angeles-Long Beach, with participation by the U.S. Coast Guard (USCG), operates the VTIS. In return, the VTIS monitors all vessel movements via radar and provides information to all commercial vessels in the VTIS area of responsibility. The VTIS (using USCG authority) may control vessel movements when necessary.

The VTIS requires that vessels entering VTIS's San Pedro Sector from the sea contact San Pedro Traffic (VHF-FM Channel 14) and report the following information:

- Vessel name and call sign;
- Position (latitude and longitude);
- Course and speed;
- Vessel destination;
- Whether the vessel is taking a pilot or being piloted by a master or commanding officer; and
- Estimated time of arrival to the sea buoy, pilot boarding area, or El Segundo offshore mooring area.

The VTIS requires that vessels departing offshore Marine Terminal moorings notify San Pedro traffic 15 minutes prior to initiating movement within the San Pedro Sector and provide the following information:

- Vessel name and call sign; and
- Vessel destination port or direction of departure.

Additionally, tankers that arrive from Prince William Sound, Alaska, are required to be equipped with Automatic Dependent Surveillance Shipboard Equipment, a type of Automatic Identification System (AIS). This system automatically transmits global positioning system information from the vessel to the VTIS so that the vessel's exact position can be monitored without the aid of radar.

Area Sensitive Receptors

The Marine Terminal onshore facilities are immediately adjacent to the bike path that travels along the beach area connecting the cities of El Segundo and Manhattan Beach. Pump and pipelines are located approximately 60 to 80 feet (18.3 to 24.4 m) from the bike path. Residential areas are located approximately 0.3 miles (0.5 km) to the northeast from the Marine Terminal in El Segundo (along Binder Place and Loma Vista Street) and approximately 0.5 miles (0.7 km) to the south of the Marine Terminal in Manhattan Beach (along 45th Street and Strand Street). Vista Del Mar runs immediately along the east of the Marine Terminal, approximately 85 feet (25.9 m) from the pumping areas.

Spill Response Capabilities

All marine terminals and all vessels calling at marine terminals are required to have Oil Spill Contingency Plans and a certain level of initial response capability. The requirements for this level of capability are in the process of being increased in response to recent Federal and State legislation (see Section 4.1.2, Regulatory Setting, for a discussion of this legislation). Chevron is equipped to respond to oil spills at the Marine Terminal and has a program for preparing and executing a marine oil spill response. The Marine Terminal area of response encompasses Santa Monica Bay, including shorelines from Point Dume south to Point Vicente.

In light of the recent BP oil spill in the Gulf of Mexico, some changes may be forthcoming in regards to the response planning. These items may include the appropriate use of dispersants. Dispersants have been controversial during the BP oil spill and both the Environmental Protection Agency (EPA) and BP have studied their use. Appendix H contains information on these dispersant studies and the oil spill generally.

Response to Spills at the Marine Terminal

Chevron's primary documents containing oil spill planning information and procedures are the Marine Terminal Oil Spill Contingency Plan (Chevron 2008) and the USCG Terminal Manual (Chevron 2004b). Copies of both documents are located in Chevron's El Segundo Refinery's Marine Terminal Control Room. A copy of the Marine Terminal Oil Spill Contingency Plan is also kept at the Beach Oil Spill Headquarters building at the Refinery.

The Oil Spill Contingency Plan documents the Marine Terminal's strategy and tactics for planning and executing a response to an oil spill, including organization of the Oil Spill Response Team, response and notification procedures, and environmental protection procedures. It also provides critical reference material, such as maps and a directory of resources and services. It is a 'living document,' which is revised periodically as needed. It was submitted to and granted approval by the California Department of Fish and Game (CDFG) Office of Spill Prevention and Response (OSPR) on April 1, 2008. The USCG approved the plan on July 1, 2008, in accordance with the contingency requirements, and it will expire on July 1, 2013.

Chevron submitted an updated spill response manual, as required by the Oil Pollution Act of 1990 (OPA 90), to the USCG, the EPA, and OSPR that, among other things, included calculations to establish a worst-case discharge from the Marine Terminal and to show how and with what assets Chevron would respond to a worst-case spill. The size of the worst-case accident is based on the amount of oil or product that could be released from the loading and unloading pipelines, taking into consideration the length of time it would take to detect the release, shut down pumps, and close valves.

Additionally, the Oil Spill Contingency Plan documents the training, drills, and exercises that prepare the Oil Spill Response Team for implementing the plan:

- **Training**. Oil Spill Response Team members receive training in accordance with Title 29 of the Code of Federal Regulations (CFR) (Part 1910.120(q) [Hazardous Waste Site Operations and Emergency Response]). Training levels required for individual team members are commensurate with each member's assigned duties. Chevron also holds indoctrination programs for new boat crews and beach supervisors to familiarize them with their specialized duties.
- **Drills**. To maintain response preparedness, drills are conducted at least semiannually for offshore spill containment and at least annually for beach cleanup. Drills include detection and assessment, control actions, communications, and documentation.
- **Exercises**. Chevron typically stages two to four exercises per year that involve Chevron's entire fleet. Marine Spill Response Corporation (MSRC) participates in four exercises per year. The USCG, California State Lands Commission (CSLC), and OSPR are invited to participate in and observe all exercises.

Chevron maintains the following to execute its Oil Spill Contingency Plan:

- An Oil Spill Response Team;
- Staged response equipment;
- An inventory of supplies and support equipment;
- A command center with helipad and communications network;
- Membership in several oil spill response cooperatives; and
- A directory of contracted services and suppliers, including contractors and suppliers with who Chevron has standing contracts and service agreements.

The Oil Spill Response Team of 100 members includes 25 members trained and capable of responding offshore and 75 members trained to operate the Incident Command System onshore. Chevron response personnel are prepared to respond to a spill 24 hours per day. They actively assisted in the response to the 397,000-gallon (9,458-barrel (bbl)) *American Trader* spill in Huntington Beach in February of 1990.

Under CSLC regulations, all offshore marine terminals are required to either (1) deploy boom, prior to transferring oil, in a specified manner to enclose the water surface surrounding the vessel or (2) provide sufficient boom appropriate for the conditions at the terminal, trained personnel, and equipment maintained in a standby condition at the berth for the duration of the entire transfer operation, so that a length of at least 600 feet (182.9 m) of boom can be deployed within 30 minutes of a spill (CSLC 1994). Chevron deploys a dedicated response tug boat at the Marine Terminal whenever a vessel is loading or unloading. In addition, Chevron has contracted with Gulf Caribe Maritime to supply a crew boat capable of deploying a boom within 30 minutes to stand by the Marine Terminal during transfer operations. The Gulf Caribe Maritime's boats *Keith K* and the *Caribe Alliance* are each capable of deploying a 600-foot (182.9-m) boom within 15 minutes of notification.

Response equipment is staged in several locations to facilitate rapid boom deployment. The Marine Terminal maintains an inventory of response supplies, including booms, sorbent pads, protective clothing, communications equipment, shovels, pumps, generators, lighting, and first aid kits. Table 4.1-2 lists the stockpiled materials and equipment.

The dedicated headquarters for the Chevron Oil Spill Response include two command trailers at the Marine Terminal that are outfitted for the spill management team, a helipad, and direct beach access. Designated desks in the trailers can accommodate agency representatives who need to be involved in incident management and oversight.

Additionally, several Chevron corporate functional teams are available to provide support to the Marine Terminal: Communications, Finance, Environmental, Facilities, Human Resources, Insurance/Claims, Law, Medical, Public Affairs, Purchasing, Safety, Fire and Health, Security, and Transportation.

As warranted by an incident, Chevron can also draw on the support of additional cooperatives, contracted services, and suppliers. In addition to Chevron's onsite personnel and equipment, spill response support for the Marine Terminal is primarily provided by the MSRC, an oil spill cooperative that is currently the largest U.S. oil spill response organization for coastal and offshore oil spills.

Table 4.1-2
Local Chevron Spill Response Resources

Category	Quantity	Description	Location
Boats	1	55-ft (17-m) Rozema (Boomer) with 1000 ft (304 m) boom	King Harbor
	1	44-ft (13-m) Munson Boat (MSRC) with 1,000 ft (304 m) boom	King Harbor
	1	36-ft (11-m) Munson Boat (VANGUARD) with 1,000 ft (304 m) boom	King Harbor
	1	32-ft (10-m) Utility 1 (fast response boat)	King Harbor
Vehicles	7	Pickup Trucks (4-Wheel Drive)	El Segundo Refinery
	2	110 bbl Vacuum Trucks	Motor Vehicle Group
Booms	1,500 ft	Oil Spill Boom (12-in float & 12-in skirt [0.3x0.3m])	Oil Spill Warehouse
	2,000 ft	Oil Spill Boom (6-in float & 12-in skirt [0.15 m & 0.3 m])	Oil Spill Warehouse
	250 ft roll	3M Sorbent Boom (8-in diameter by 24-in [0.2 m by 0.6 m])	Oil Spill Warehouse
	1,000 ft	Sorbent-Science Sausage Boom	Oil Spill Warehouse
	1,000 ft in 20 cartons	Snare Boom (OS-15R 300/S)	Oil Spill Warehouse
Sorbent	70 (100 sheet bags)	3M Oil Sorbent Pads (17 in x 19 in [0.4 m x 0.5 m])	Oil Spill Warehouse
	5 (100 sheet bags)	3M Oil Sorbent Pads (18 in x 18 in [0.4 m x 0.4 m])	Oil Spill Warehouse
Communication Equipment	5	AT&T Cellular Phones	Dispatch
	12	Beach Hand Radios (WQI-79/KHS-42)	Beach Headquarters
	1	Multiple Frequency Base Station	Beach
	12	Marine Hand Radios (KTP 616/SCPCO)	Oil Spill Warehouse
	12	Hand-Held Radios	Oil Spill Boats, KH
	9	VHF Radios	Oil Spill Boats, KH
Shovels/Rakes/Tools	15	Pitchforks with Wire Mesh	Oil Spill Warehouse
	8	Pitchforks without Wire Mesh	Beach
	8	Steel Rakes	Oil Spill Warehouse
	15	Shovels	Oil Spill Warehouse

Table 4.1-2
Local Chevron Spill Response Resources

Category	Quantity	Description	Location
	2	Tool Kits	Oil Spill Warehouse
Rope/Cable	1 Coil	¾ in x 500 ft (1.9 cm x 152 m) Polypro Lines	Oil Spill Warehouse
	600 ft (180 m)	¾ inch rope	Refinery Storehouse
	1	Hoist Chain	Refinery Storehouse
Generators	20	110-volt Generators	Central Tool Room
Pumps/Motors	1	42 gal/min Diaphragm Pump	Oil Spill Warehouse
	1	42 gal/min Centrifugal Pump	Oil Spill Warehouse
	2	42 gal/min Pneumatic Pumps	Marine HQ Van
Chemicals	50 lbs	Hand Cleaner	Refinery Storehouse
Road Barriers	16	Road Barricades	Plant Security
	2	"Road Closed" Signs	Plant Security
	4	2 in x 6 in (0.1 m x 0.2 m) Road Blocks	Plant Security
	3	Red Warning Flags	Plant Security
Miscellaneous	20	Steel Plates (¼ in x 8 ft x 12 ft [0.064 cm x 0.2 m x 0.4 m])	Reclamation
	1	Headquarters Office Building (12 ft x 60 ft [4 m x18 m])	Beach Headquarters
	2	First-Aid Kits	Oil Spill Warehouse
	200	Burlap Bags	Refinery Storehouse
	100	Flashlights	Refinery Storehouse
	500	“D” Batteries	Refinery Storehouse

Notes: ft = feet; m = meters; bbl = barrels; in = inches; gal = gallons; min = minutes
Source: Chevron 2008

Oil spill cooperatives allow member companies to pool their spill response resources, thereby effecting response capabilities that no single company, contractor, or government entity could provide alone. Oil spill cooperatives also train member-company personnel and participate in regular member-company drills.

The MSRC is funded by more than 100 companies engaged in the business of petroleum exploration and production, refining and marketing, transportation and shipping. It was founded in 1990 to offer spill response services, mitigate damage to the environment from spills, and help member companies of the Marine Preservation Association satisfy their facility and vessel response planning requirements mandated by OPA 90. MSRC assists in major responses that exceed the capabilities of local response organizations. Headquartered in Washington, D.C., MSRC has four regional response centers and approximately 80 pre-positioned sites with equipment, vessels, and personnel. The California response center is located in Concord, California.

The MSRC has prepared response plans for small spills requiring minimal manpower and logistics support, as well as for large spills requiring major manpower, logistical support, and interface with public and private agencies. Additionally, in 2004, MSRC merged with the assets of two west coast oil spill cooperatives, the former Clean Coastal Waters in Long Beach and the former Clean Bay in San Francisco. Through this merger, MSRC expanded its inventory of response vessels, equipment, and spill cleanup resources. Through agreements established by Clean Bay and Clean Coastal Waters, MSRC has a number of companies under contract to provide equipment, services, and manpower as required to respond to spills along the west coast.

The Chevron El Segundo Marine Terminal is located within MSRC’s Long Beach area of operation, which encompasses the area from Point Dume, in the north, to the Mexican border. MSRC’s Long Beach-area oil spill contingency plan, which is continuously updated and modified, includes alert callout and notification procedures, responsibility descriptions, an organizational relationship structure for all levels of personnel involved in a spill-response effort, and a listing of the cooperative's resources. As noted in Chevron’s Oil Spill Contingency Plan, MSRC’s Long Beach-area assets can provide a total response capacity of 52,628 barrels per day (bpd), which exceeds the 50,000 bpd maximum response capacity required by state regulations for a high-volume port (Chevron 2008).

The Long Beach-area inventory contains a full range of spill response tools and equipment, including:

- Four oil spill response vessels equipped with various types of equipment including booms, skimmers, dispersant systems, absorbents, and oil storage containers; one is normally located at Berth 29 and three are located at Berth 57 of the POLB;
- Four fast-response boats, two of which are normally located at Berth 57 and the other two at Berth 59 of the POLB;
- Eight work boats ranging in length from 12 to 21 feet (3.7 to 6.4 m), for support boom management, sorbent use, personnel transfer; and
- Various equipment including skimmers, spill-containment booms, oil storage equipment, and other communication and support equipment including equipment owned by cooperative members.

In addition to its own array of equipment, MSRC also has a mutual aid agreement with Clean Seas Inc. of Santa Barbara, California, to supply 400 laborers within six hours of a call, and MSRC will contact them if needed in response to a spill in the vicinity of the Marine Terminal. The Clean Seas Inc. cooperative is a non-profit spill response organization formed by member companies in San Luis Obispo, Santa Barbara, and Ventura counties. Their area of interest is public and private properties, beaches, harbors, and offshore islands and waters along the coast of the State of California between and including Cape San Martin to the north and Point Dume to the south. The Clean Seas manual identifies estuaries along the coast and provides booming strategies for excluding oil from these estuaries. The manual also outlines shoreline cleanup techniques and strategies. The U.S. Navy and USCG could also be called upon in the event of an oil spill. The U.S. Navy Supervisor of Salvage (SUPSALV) in Stockton, California, and the USCG Pacific Strike Team in Novato, California, would provide support to help contain and remove oil at the Marine Terminal in the event of a spill. Their services would be called upon if the organizations located closer to the Marine Terminal required assistance. Specifically, the USCG on-scene coordinator can access SUPSALV equipment at Chevron's request.

Finally, Oil Spill Response Limited would provide necessary assistance pursuant to an agreement between Chevron and Oil Spill Response Limited, whereby Chevron has access to 50 percent of each type of equipment (e.g., booms, skimmers, temporary oil storage, pumps, and dispersant equipment) in addition to response personnel not otherwise allocated to another oil spill response. Oil Spill Response Limited grew out of BP's Oil Spill Service Centre, a non-profit established in the early 1980s. In 1985, several companies formed a cooperative and incorporated as Oil Spill Response Limited. Currently, more 100 organizations are members of the cooperative, which is owned by 35 of those organizations. Oil Spill Response Limited can deploy aerial dispersants worldwide; maintains equipment stockpiles in Bahrain, Singapore, and England; and has two Hercules aircraft ready for equipment deployment and aerial dispersant spraying (OSPR 2010). Oil Spill Response Limited equipment would be deployed only if equipment located near the Marine Terminal in California was inadequate to contain and remove the oil.

Response to Spills from Vessels In Transit

Response to a spill from a vessel is the responsibility of the owner/operator. The OPA 90 requires that each vessel has an Oil Spill Contingency Plan identifying the worst-case spill (defined as the entire contents of the vessel) and the assets that will be used to respond to the spill. Chevron, which owns some of the smaller-size tankers that call at the Marine Terminal, has developed plans in accordance with OPA 90. The response capability of other tanker companies and barge companies that call on the Marine Terminal is less known; however, they are required to have spill response plans per federal regulations (33 CFR 155, Subpart D).

A vessel would respond to a spill with containment (deploying booms), recovery (deploying skimmers), and the protection of sensitive resources. If the oil reached the shore or fouled wildlife, the response would require cleaning of the shoreline and wildlife. Marine Spill Response Corporation and other cooperatives, such as Clean Seas, would make their local equipment and manpower available. If required, additional equipment and manpower would be made available from local contractors and other spill cooperatives.

Weather conditions may play a large role in response to an accident in the shipping lanes. Sea conditions farther offshore may be more difficult to work in because booms lose their effectiveness rapidly when waves exceed six feet (1.5 m). Thus, there may be conditions that would make it impossible to provide any response actions. However, when waves are so high that it is impossible to deploy response equipment, the wave energy normally disperses oil more rapidly.

Chevron Response to Specific Scenarios

Chevron's Oil Spill Contingency Plan establishes a series of safeguards to detect leaks and spills, to contain and recover released oil, and to protect and restore environmental resources after a spill.

Beach Protection Plan

Chevron developed beach protection and cleanup plans for nine sections of shoreline extending from Point Dume to Flat Rock Point, including special provisions for Ballona Creek (see Figure 2-2). Each beach cleanup plan contains a description and map of the beach, including areas of specific concern, access points, beach headquarter locations, and appropriate cleanup equipment and methods. This approach enables the teams to mobilize and respond quickly so that valuable time is not lost becoming acquainted with beach features and unique needs.

The CDFG is responsible for collecting, cleaning, and rehabilitating wildlife that has come in contact with oil after a spill. The CDFG has accredited private wildlife organizations to perform these tasks. Chevron's Wildlife Care Team in El Segundo can assist CDFG and its designated organizations. The team coordinates all Chevron activities dealing with wildlife and notifies appropriate agencies as required. After the *American Trader* spill at Huntington Beach in February of 1990, the Wildlife Care Team assisted in bird cleaning and rehabilitation. Several members of the boom boat crew have also volunteered for the wildlife team to assist in observing and rescuing oiled birds, as directed by CDFG.

Leak Detection

While the Marine Terminal is operating (i.e., tankers are present) a pressure point analysis system is used in combination with visual inspections to detect leaks. The pressure point analysis system monitors the pipeline pressure during transfer operations and utilizes a computer algorithm to estimate a leak. The working pressure of the pipelines is normally 180 pounds per square inch absolute (psia) (1.2 [megapascals [MPa]); the pressure limit is 275 psia (1.9 MPa). A separate pressure alarm is set at 240 psia (1.6 MPa). A change in pressure that suggests a suspected leak sets off a system alarm. This pressure alarm is tested quarterly. Crew and operations personnel also visually inspect the ocean area around a vessel and areas within the onshore Marine Terminal for potential leakage.

When the Marine Terminal is not operating, a continuous vacuum system and monitoring and visual inspections by operators detect releases. A continuous vacuum system provides a warning for leaks when the pipelines are not in use. The pipelines are normally full of hydrocarbon fluid when not in use; a leak during this period could release that fluid into the Bay. With the vacuum system, a low rate pump applies a slight continuous vacuum on the pipeline when not loading or unloading. If the pump operates for more than 10 minutes to maintain the vacuum, then a leak is suspected and an alarm is sounded.

The Marine Terminal can activate high-capacity pumps capable of pumping the pipeline volume back to the onshore tanks, drawing in seawater, and minimizing the size of a leak. This system would be manually activated if operators detect a leak.

Spill Response Activities

Once a release is detected, personnel would implement initial response procedures to locate and stop the source of the spill, assess the severity of the incident, notify appropriate Chevron personnel (who will then activate the Oil Spill Contingency Plan) and regulatory agencies, and initiate containment of the spill and protection of sensitive resources.

Methods of shutting off the source of a release will vary with each specific incident. Examples include:

- Shutting off onshore or ship pumps to stop the flow of oil;
- Activating onshore pumps (high rate) to draw seawater into the affected pipeline; and
- Closing the seaside block valves.

Chevron's Oil Spill Contingency Plan contains procedures for activating and implementing a response to an oil spill, and personnel are prepared to respond to a spill 24 hours a day. If a release occurs during a transfer operation, the following response assistance is also available:

- Boom is on hand at all times (a minimum of 1,000 feet [304.8 m]) during the transfer operation and can be deployed immediately from the line launch boat and response boat; and
- Response boats in King Harbor can be deployed and onsite within approximately 60 minutes (see Table 4.1-2).

Spilled oil and oil-contaminated materials recovered from land and water spills require proper handling. In accordance with 40 CFR Parts 261 and 265 (mandated by the Resource Conservation and Recovery Act [RCRA]) and California Code of Regulations (CCR) Title 22, Division 4, Chapter 30, Chevron established procedures to manage incident-derived waste.

A Waste Management Specialist is designated to oversee the following waste management objectives:

- Waste minimization;
- Minimization of impact on unaffected areas or areas that have already been cleaned;
- Regulatory compliance;
- Worker safety;
- Proper disposal; and
- Cost effectiveness.

The Oil Spill Contingency Plan contains procedures for collection, characterization, temporary storage, source reduction, transportation, waste handling, recycling, treatment, and landfilling.

Based on Chevron's Oil Spill Contingency Plan, the following paragraphs assess Chevron's ability to respond to specific types and sizes of spills.

Oil Spills Less Than 50 Barrels

The USCG, in response to OPA 90, requires that marine terminals can respond to a small spill (2,100 gallon [50 bbl] or less) with the following equipment:

- 1,000 feet (304.8 m) of containment boom and means to deploy it within one hour;
- Oil recovery devices deployed within two hours; and
- Oil storage capacity for recovered oily material.

Chevron would respond to a 50-bbl spill with in-house resources. Most of the resources are marine-oriented to facilitate response to marine spills or land events that threaten to enter the marine environment.

After deploying one or more booms and containing some of the spill, Chevron personnel can begin recovery, including storage capacity and skimming capability. While recovery should start as quickly as possible, initial efforts should concentrate on containment. If the oil cannot be contained locally, then an attempt would be made to contain as much as possible as it drifts from the site. Additional booming to protect sensitive resources might also be required. Chevron, together with MSRC, under most conditions, should be able to contain and recover the majority of this amount of spilled oil. However, some oil would evaporate and some would mix with the water.

Oil Spills Between 50 and 1,000 Barrels

For a spill of this size, as necessary, the resources of MSRC (Long Beach) and local contractors would be utilized for response implementation. Depending on the amount of oil released and the current environmental conditions (e.g., tide, wind, and local currents), the deployment of the booms described in the above section may or may not be sufficient to encircle the oil. If it is not, then additional boom lengths would be deployed. The MSRC would be notified immediately to send their response vessels, recovery capability, and storage. The MSRC can provide skimmers (oil recovery devices) within approximately two hours.

In this spill size range, modeling of 42,000-gallon (1,000-bbl) spills at the Marine Terminal shows that cleanup response would depend upon weather conditions and would not be significantly influenced by tidal conditions (see discussion in Appendix C, Oil Spill Modeling). If currents were not substantial and wind conditions were normal, a spill of this size may be able to be contained at the Marine Terminal or to a short stretch of coastline nearby. If conditions were not favorable and the spill were not contained, the response strategy would be to contain and recover as much oil as possible and to try to protect sensitive resources in the direction the spill was heading.

The line launch boat could deploy a boom ahead of the oil, which under prevailing conditions would head toward shore. Depending on the amount of oil released, one method of deploying the boom would be to encircle all or some of the oil with the boom and then let the boom and encircled oil drift. The boat could then deploy additional booms as needed.

Oil Spills Greater than 1,000 Barrels

For this size spill, additional oil booms in onsite Refinery storage could be used:

- 0.4 miles (0.6 km) of Sea Curtain boom (six-inch [0.1-m] float and 12-inch [0.3-m] skin);
- 0.3 miles (0.5 km) of Sea Curtain boom (12-inch [0.3-m] float and 12-inch [0.3-m] skin); and
- 0.8 miles (1.3 km) of Expandi boom (12-inch [0.3-m] float and 18-inch [0.5-m] skirt).

The results of spill modeling show that spills in this range would be widely spread under all weather conditions (see Appendix C, Oil Spill Modeling). Complete containment would be unlikely, and long stretches of coastline would typically be affected. Response would be requested from contracted and backup parties as noted in Chevron's Spill Response Manual in coordination with the USCG. The maximum response capacity available from MSRC is 93,928 bpd. By utilizing the mutual aid agreement with Clean Seas, an additional 10,282 bpd of response capacity would be available.

Response to Product Spills

Response efforts for product spills depend on the characteristics of the product. Spills of low flash point liquids create the danger of fire and explosion. When spills of these products occur, response activities become of secondary importance to the safety of life and property. Local fire departments usually become the lead agency in any of these events. They typically call for isolation of sources of ignition and evacuation of areas at risk. The operation of boats and equipment within the spill area would be limited.

Response to releases of flammable products (i.e., those with flash points below 100 degrees Fahrenheit [°F], or 37.7 degrees Celsius [°C], such as gasoline) consists primarily of ignition control. No booming or skimming would be attempted because these highly volatile products evaporate rapidly and booms/skimmers would be less effective. In addition, the deployment of booms and skimmers in close proximity to the flammable materials would be a risk to responders due to the flammable nature of the product and the high potential for flammable vapor clouds.

Response efforts for diesel oil products would be similar to those for crude oil except that many of these products are lighter and would evaporate more quickly, leaving less to contain and recover. Some limited success has been achieved in containing and recovering diesel, but, as noted in the model runs (see Appendix C, Oil Spill Modeling), large spills of diesel could still impact large areas of coastline.

Fire and Emergency Response Capabilities

Non-spill related emergencies, such as fires and medical or security emergencies, would be handled by Chevron and local response agencies.

Chevron maintains its own onsite fire and rescue services at the Refinery which is adjacent to and supports the Marine Terminal. The Refinery fire department adheres to National Fire Protection Association standards and is recognized as a professional functioning fire department by the California State Fire Marshal's office. The department is staffed with trained and certified fire fighters and emergency medical technicians. Its fire and rescue organization is capable of responding to petroleum and structural fires, hazardous materials releases or spills, and confined-space rescues.

The Refinery fire department includes a full-time staff of approximately 18 personnel, with a three-person crew on duty at the Refinery at all times. To supplement the Fire Department, an Emergency Response Team consisting of personnel from the Operations Department is trained and available to assist with any fire emergencies.

The onsite fire department holds regular training sessions and drills in conjunction with the City of El Segundo Fire Department. The Refinery also is active in the Beach Cities Community Awareness and Emergency Response organization, where industry and local government agencies coordinate emergency response activities, and is a sponsor of the Community Alert Network telephone call-out system.

The Refinery personnel notify the City of El Segundo Fire Department when an incident occurs that may affect the public or when it is not able to handle the emergency without assistance. The Refinery can request the assistance of other refineries and industrial organizations in the area, if necessary. The fire and rescue personnel maintain the following equipment:

- Two fire engines;
- One fire truck equipped with a 105-foot (32.0-m) aerial;
- Five quick-response trucks;
- Various trailer-mounted monitors;
- A hazardous material rescue truck;

- Two foam tankers each with 2,500 gallons (9.5 cubic meters [m^3]) of capacity and 6,000 gallons (23 m^3) of reserve storage; and
- Connection to the Refinery fire water system with 15,600 gallons (59.1 m^3) per minute of capacity supplied by the Refinery industrial water system and a 4 million gallon emergency fire water reserve tank.

Additional fire response equipment maintained at the onshore Marine Terminal facilities includes 12, 30-pound (13.6-kilogram [kg]) dry chemical hand-held extinguishers, hydrants, fire hose stations, fire monitors, and halon extinguisher systems located at the Berth 3 transfer pump and four hose stations and one hydrant located at the Berth 4 transfer pumps. Fire block valves are also located at the eastern perimeter of the on-shore facilities for fast isolation of Refinery systems from shipping facilities. These valves are either tested for leakage or maintained to achieve 100 percent isolation each year during the facility's annual shutdown.

Fire boats are also available from the POLA or POLB harbors. Because the transit time from these harbors is approximately one to two hours, these fire boats would be called upon only in the event that Chevron's onsite equipment in combination with a ship's equipment is unable to control a shipboard fire.

City of El Segundo Fire Response Capabilities

The Refinery is also served by the City of El Segundo Fire Department. The City maintains two fire stations within El Segundo. Station No. 1 is normally manned with 10 personnel and is equipped with two engines, one paramedic unit, and one command vehicle. Eight personnel are normally on duty each day at Station No. 2. This station has one engine, a truck and a paramedic unit. The City has mutual aid agreements with fire departments in the cities of Manhattan Beach, Hawthorne, Hermosa Beach, Redondo Beach, Torrance, Gardena, Inglewood, and Los Angeles.

Emergency Medical Services

Chevron has trained personnel at the Refinery capable of providing medical services. The Refinery medical clinic is staffed with nurses capable of providing basic urgent medical care. All personnel have received emergency medical training.

In addition to the medical services provided by the local police and fire departments, privately owned medical facilities exist nearby that are available in the event of an emergency at the Chevron Refinery. Nearby medical facilities include the Daniel

Freeman Medical Center in Marina Del Rey, Daniel Freeman Memorial Hospital in Inglewood, and Torrance Memorial and Little Company of Mary Hospitals in Torrance.

Security Services

As required by Federal regulations under the Maritime Transportation Security Act, (33 CFR 105), Chevron has developed a Facility Security Plan that was approved by the USCG and Department of Homeland Security on December 29, 2004. The State of California also requires marine terminals to develop a security plan (Title 2, Division 3, Chapter 1, Article 5.1). Chevron's Facility Security Plan was initially approved by the CSLC on August 16, 2002.

Chevron provides its own security force for the Refinery. Chevron employs two full-time security professionals who are supported by more than 30 contract security guards assigned to various posts. The Refinery is also served by the City of El Segundo Police Department, which has 67 sworn officers and 26 non-sworn officers. The City has mutual aid agreements with the police departments of the cities of Manhattan Beach, Hawthorne, Hermosa Beach, Redondo Beach, Torrance, Gardena, Inglewood, and Palos Verdes Estates, and with the Los Angeles County Sheriff's Department.

Historical Spills

Historical spills are associated with vessel traffic mostly into and out of the POLA/POLB and spills associated with the Marine Terminal. Marine vessel accidents include vessel allisions (between a moving vessel and a stationary object, including another vessel), collisions (between two moving vessels), and vessel groundings.

Marine Terminal Spills

On March 16, 1991, the tanker *Omi Dynachem* severed a 26-inch (0.7-m) pipeline at Berth 3 of the Chevron El Segundo Marine Terminal. When the *Omi Dynachem* attempted to anchor and hook up to the mooring, a hydraulic winch failed and caused the ship to abort the attempt and weigh anchor. The mooring pipeline was severed when it was snagged by the starboard anchor. The spill was reported as approximately 9,240 gallons (220 bbl). The slick reportedly extended four miles (6.4 km) and affected Malibu Creek 16 miles (25.7 km) from the Marine Terminal, but dissipated within two days (Incident News 2009). The spill led to the removal of Berth 2.

Since 1992, the CSLC has tracked oil spills from marine terminals. From 1992 to 2001, a total of 128 spills, ranging from a few teaspoons to 1,092 gallons (26 bbl), occurred at

California marine terminals. This equates to approximately 13 spills per year. Terminal spills were responsible for approximately 57 percent of the spills recorded, while vessel incidents were responsible for the remaining 43 percent.

Table 4.1-3 lists the 62 reported spills at the El Segundo Marine Terminal from 1977 to 2002. Assuming the same vessel call rate over the timeframe that occurred between 2002 and 2008, this would equate to a spill rate of 8.5 spills per 1,000 vessel calls. Of the Marine Terminal spills, 58 percent of the reported spills were small, consisting of less than one gallon of spilled material. Only one major oil spill (greater than 42,000 gallons [1,000 bbl]) occurred during this 26-year period; as discussed previously, in December 1980 a stress fracture in the hull of the *John McCone* resulted in the release of an estimated 105,000 gallons (2,500 bbl) of crude oil into Santa Monica Bay.

Table 4.1-3
Chevron El Segundo Marine Terminal Historical Oil Spills

Source	Date	Berth	Spill size (gallons)	Material Spilled	Comments
Hannah	1/23/77	1	<1	Thinner	
Chevron Oregon	1/25/77	4	<1	Lube Oil	
J.H. Tuttle	1/25/77	2	<1	Gasoline	
Chevron Colorado	2/5/77	2	<1	Lube Oil	
Messiniaki Andrei	2/24/77	4	2	Lube Oil	
Hosevalve Cover	7/5/77	3	10	Cutter	
3 Berth Bull Plug	7/8/77	3	<1	Cutter	
Manhattan	9/20/77	4	2,100	Crude	Tank Overflowed
Saga Maru	9/21/77	-	<1	Fuel Oil	
Sydhave	1/1/78	-	20	Gas Oil	Hose Leak
Sohio Resolute	2/22/78	-	100	Crude/Gas Oil	
Manhattan	5/18/78	4	<1	Crude	
Exxon Philadelphia	7/11/78	4	<1	Bow Thruster	
Hose Leak	8/12/78	4	1	Crude	
Manhattan	1/16/79	4	100	Crude	
Hydraulic Hose	3/13/79	3	2	Lube Oil	Boom Hose Broke
Sub Hose	4/9/79	4	1	Gas Oil	
Chevron Oregon	4/30/80	-	10	Fuel Oil	
Juanita	9/2/80	4	1	Lube Oil	
Kenai	9/20/80	4	<1	Crude	
John McCone	12/28/80	4	105,000	Crude	Hole in Ship's Bottom
Chevron California	6/24/82	3	18	Gas Oil	Ship Pump Failure
Texaco Maryland	7/30/82	2	3	Gasoline	Hose to Pipe Leak
Houston Trader	4/25/83	3	10	Crude	Hose Leak

Source	Date	Berth	Spill size (gallons)	Material Spilled	Comments
World Kudos	8/12/83	3	1	Crude	
Hose Leak	9/12/83	1	2	Polymer	
Houston Trader	1/18/84	4	84	Crude+Sort	Inert Gas System
Unknown	4/22/84	1	<1	Sheen	Light Sheen
Line Leak	4/26/84	4	<1	Gas Oil	Pinhole Leaks
Unknown	4/30/84	4	<1	Unknown	Light Sheen
Line Leak	6/12/85	1	42	Polymer	During Turnaround
Hose Leak	4/28/86	4	2	Gas Oil	Leaking Hose Bond
Hose Leak	5/27/86	2	41	Gasoline	Previous Cargo Methyl tert-butyl ether
St. Emilion	6/5/86	2	252	Gasoline	Crack in Ship
Hose Leak	8/4/86	2	5	Diesel	Defective Hose Flange
D.B. Simpson	1/23/87	2	2	Thinner	During Turnaround
Unknown	6/23/87	-	60	Fuel Oil	Sheen 1 Mile North
Cove Trader	10/5/87	3	<1	Crude	Overfilled Tank
Unknown	1/20/88	2	1	Gasoline	Sheen
Chevron Sun	9/7/88	4	<1	Gas Oil	Stern Tube Failure
Unknown	4/15/89	3	<1	Hydrocarbon	
Hose Leak	4/22/89	3	<1	Gas Oil	#89038 pinhole leak in hose
Chevron Louisiana	5/07/89	3	<1	Hydraulic Oil	#89038 bow thruster seal
British Success	8/09/89	4	<1	Oman	Tank overflow
Iver Alke	12/3/89	3	150	FOC Feed	Overflow of ship's tanks
Line Leak	7/17/90	2	5	Jet Fuel	#90028 hose disassembly during shutdown
Omni Dynachem	3/17/91	3	9,200	Gas Oil	#91017 anchor snagged #3 berth subline while in #2 berth
Line Leak	3/29/91	3	<1	Gas Oil	#91024 leak occurred while trying to repair subline

Source	Date	Berth	Spill size (gallons)	Material Spilled	Comments
Chevron Louisiana	6/20/92	3	<1	Hydraulic Fluid	
TS Kenai	6/28/92	4	8	Alaska North Shore Crude	#92035 inward valve was 1/4 turn open and sea chest block leaked
Weyerhauser	10/2/92	4	<1	Gas Oil	#92053 leaked occurred while pressure testing hose & temporary connection broke aboard ship
A.W. Clausen	11/2/92	2	<1	Reformate	#92054 When disconnecting hose it released reformate while in berth
Chevron Mississippi	11/2/92	3	<1	Slop Oil	#92055 Pulling sea water to flush line to the Refinery it back-pressured and released some slop oil
Unknown	11/5/92	3	<1	Oil Sheen	#92058 The *Oregon* noticed an oil sheen in the water, source unknown
Unknown	11/22/92	3	Sheen	Oil Sheen	#92057 The *Mussman* noticed sheen while pulling out of berth
Chevron Oregon	12/26/92	3	<1	Hydraulic Oil	#92058 Leak came from mechanical seal from bow thruster
Shilo Spirit	6/13/93	4	<1	Gas Oil	#93012 leak on flange at end of hose during pressure test
Chevron Louisiana	9/4/95	3	<1	Hydraulic Oil	Crane hydraulic line leak; repaired.
Line Leak	2/9/97	4	<15	Gas Oil	Flange leak; repaired; sorbents used.
Chevron Washington	8/4/98	4	<1	Hydraulic Oil	Stern tube leak; responded with sorbent boom.
Celiamar (non-Chevron vessel)	7/14/01	3	<1	Hydraulic Oil	Hose fittings leak; fitting repaired.
Polar California (non-Chevron vessel)	5/19/02	4	<1	Hydraulic Oil	Hose fittings leak; fitting repaired.

Notes: - = unknown
Source: Chevron 1993, Chevron 2003

Tanker Spills and Accidents

Prior to 1973, when more stringent reporting requirements were introduced, international spill occurrences were irregularly recorded. Following that time, from 1974 through 1999, there were 278 spills exceeding 42,000 gallons (1,000 bbl) from ocean-bound crude oil carriers worldwide (Anderson and LaBelle 2000). Forty-six of these spills occurred in U.S. coastal and offshore waters. Between 1977 and 1999, 11 tanker spills greater than or equal to 42,000 gallons (1,000 bbl) were associated with the transportation of Alaskan North Shore crude oil, including the 10 million gallon (240,000 bbl) Exxon Valdez spill (1989). The ten other large spills that occurred during this time period were all less than or equal to 630,000 gallons (15,000 bbl) in size (Anderson and LaBelle 2000).

The USCG maintains a series of databases on spill incidents in US waters for all spills large enough to produce a sheen (USCG 2009). The most recent database, the Marine Information for Safety and Law Enforcement Marine Casualty and Pollution Database (developed in 2001), reports 959 tanker pollution incidents between 2002 and 2006, 80 of which were located off the coasts of California, Oregon, and Washington.

The Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE) maintains a similar database of tanker spills that exceed 42,000 gallons (1,000 bbl) in size. According to both the MMS database and the USCG, from 1974 through 2007, the Los Angeles area experienced five large spills (greater than 1,000 bbl) (MMS 1994, USCG 2009, Incident News 2009). These are listed in Table 4.1-4 and discussed in the following sections.

Table 4.1-4
Tanker Spills in the Los Angeles Area
Greater Than or Equal to 42,000 Gallons (1,000 Barrels)

Spill Date	Vessel Name	Oil Type	Spill Location	Amount Spilled, gallons (bbl)
10/04/74	*Sea Spirit*	Crude	Los Angeles Harbor	2.1 million (50,028)
7/16/75	*Pera (Lorenzo Halcoussi)*	Bunker C/ No. 6 Fuel	Los Angeles Harbor	84,000 (2,000)
12/17/76	*Sansinena*	Naptha/No. 6/ Bunker Fuel	Los Angeles Harbor	1 million (23,810)
12/28/80	*John A McCone*	Heavy Crude	El Segundo/Long Beach	105,000 (2,500)
2/7/90	*American Trader*	North Slope Crude	1.5 miles off Huntington Beach	397,236 (9,458)

Note: Incident News and the USCG 2009 indicate no spills in the LA area greater than 1,000 bbl since 1990.
Source: MMS 1994, Incident News 2009, USCG 2009

On February 7, 1990, the single-hull tanker *American Trader* grounded on one of its anchors while approaching the Golden West Refining Company's offshore mooring near Huntington Beach, California. Two holes were punctured in one of the vessel's cargo tanks, releasing 397,236 gallons (9,458 bbl) of heavy crude oil into the water approximately 1.3 miles (2.1 km) from Huntington Beach. Oil continued to come ashore through February 12, 1990, with some sheen and floating oil scattered on February 14, 1990. By February 16, 1990, very little on-water oil remained, although a small amount of oil was still coming ashore on February 18, 1990 (Incident News 2009). Overall, the spill impacted an estimated 15 miles (24.1 km) of beaches.

In December of 1980, the *John McCone* developed a stress fracture in its hull which resulted in the release of an estimated 105,000 gallons (2,500 bbl) of crude oil offshore El Segundo. The stress fracture was not related to operations associated with the Marine Terminal.

In January 8, 1991, the bulk freighter *Sammi Superstars* spilled approximately 12,936 gallons (308 bbl) of an Intermediate Fuel Oil into the East Basin Channel of Los Angeles harbor (berth 176). The spill occurred when a Superstars crewmember left his station and failed to notice a fuel tank overflowing during bunkering operations. The spill caused the POLA/POLB to be closed from Los Angeles berths 170/224 to Long Beach 105 (this area encompasses the channels and basins/slips along the center 2/4's of the north side of Terminal Island). After one week, there were still scattered sheens and some oil in East Basin Channel, predominately inside the containment booms at the far western end of the closed area. Some sheens remained in the Los Angeles Main Channel area around berths 331-336. All of the sheens and oil in the Outer Harbor area were gone. This spill within the port is an example of the economic consequences of a spill causing a port closure.

On December 17, 1976, while moored at the POLA Berth 46, the Liberian oil tanker *Sansinena* exploded, split in half, and burned while taking on ballast and bunker fuel. The blast shattered windows for miles around and triggered a fire that spread across the dock and around the tanker. A USCG investigation concluded that the incident was caused by flammable vapor buildup on the deck of the ship. During ballasting, vapors were vented onto the deck area during low wind speed conditions and eventually found an ignition source. Subsequent to this event, the POLA implemented prohibitions on flammable vapor venting both during loading, unloading, and ballasting operations. This incident is an example of the types of scenarios that could occur and lead to either explosion and fire impacts or cause spills at the Marine Terminal with vessels that are not gas blanketed.

The POLA/POLB also compiles data on vessel spills and accidents. As shown in Table 4.1-5, the number of vessel incidents in the POLB and POLA ports has remained fairly constant from 1996 until 2005. The annual number of oil spills in the Port Areas of Responsibility (the ports and areas outside the port ranging north to San Luis Obispo and south to San Diego) ranged between 170 and 600 spills each year between 1998 and 2005, with sizes ranging from a few cups to more than 1,000 gallons (24 bbl) (HSC 2007).

Table 4.1-5
Vessel Incidents at San Pedro Bay Ports
1996-2005

Year	Vessel Incidents				Total Incidents	Number of Spills*
	Allisions	Collisions	Groundings	Fires		
1996	2	4	1	0	7	na
1997	1	3	2	0	6	na
1998	1	2	3	0	6	290
1999	3	4	2	0	9	480
2000	3	2	1	0	6	600
2001	4	1	0	0	5	540
2002	6	5	0	0	11	350
2003	4	2	2	0	8	200
2004	2	4	6	0	12	180
2005	0	1	3	3	7	170

Notes*:* These commercial vessel accidents meet a reportable level defined in 46 CFR 4.05, but do not include commercial fishing vessel or recreational boating incidents.
* Taken from Harbor Safety Committee Chart 2007. Data are from the entire area of responsibility for the Captain of the Port including the POLA, POLB, Port Hueneme, and the waters extending from the Orange/San Diego County line to the northern limit of San Luis Obispo County.
Source: Harbor Safety Committee 2007, U.S. Naval Academy 1999

Other Relevant Spill Incidents

The BP Deepwater Horizon Oil Spill in the Gulf of Mexico resulted from the Deepwater Horizon drilling rig explosion on April 20, 2010. The explosion killed 11 platform workers and injured 17 more workers. The floating rig subsequently sunk in one mile (1.6 km) of water. The well ll that was being drilled released oil from several locations along the drill pipe, which was bent and laid along the ocean floor. Response efforts included attempts to cap or contain the well, activate the blow-out-preventer that failed to activate and shut-in the well during the accident, inject dispersants into the plume of oil sub-sea (see Appendix H), deploy booms and skimmers over large areas of the Gulf of Mexico, and drill two relief wells. The leak continued for at least three months and was the largest spill in U.S. history. Estimates of the release volume varied considerably because accurate estimates of the flow of oil from the underwater pipes were difficult. Estimates of the volume of oil released range from 90 million to 179 million gallons (2.1 to 4.2 million bbl). (At this writing, the spill continues to release oil into the Gulf and final numbers cannot be determined.)

By mid July, 484 miles (778.9 km) of Gulf Coast shoreline were oiled: approximately 287 miles (461.8 km) in Louisiana, 71 miles (114.3 km) in Mississippi, 62 miles (99.8

km) in Alabama, and 86 (138.4) miles in Florida. Approximately 37 percent of Gulf of Mexico federal waters have been closed for fishing, extending almost 250 miles (402.3 km) east, west, and south of the release location.

Approximately 3 million feet (914.4 km) of containment boom and 5.4 million feet (1,645.92 km) of sorbent boom were deployed to contain the spill and more than 6,900 vessels responded to the site, including skimmers, tugs, barges, and recovery vessels.

Although the BP spill differs from a tanker spill since it was in very deep waters, the release location was at the ocean floor, and it continued for a period of 100 days, the extent of spill impacts gives a measure to the extents that are estimated in this EIR's modeling analysis and demonstrates the extent of spill impacts.

On September 29, 1997, Platform Irene, offshore near Point Arguello, California, reported a spill from its 20-inch (0.5-m) pipeline. This pipeline connected the platform to the shoreline terminal at Point Arguello. The amount released was estimated between 8,400 and 21,000 gallons (200 and 500 bbl). The spill soiled 17 miles (27.4 km) of beaches and caused beach closures for approximately two weeks (Incident News 2009). Reports indicate that 90 percent of the on-water oil was recovered or contained after two days. On-water collection of oil was completed October 2, 1997.

On September 21, 1987, the Liberian bulk carrier *Pac Baroness* and the Panamanian freighter *Atlantic Wing* collided in foggy, high seas conditions, 12 miles (19.3 km) southwest of Point Conception. The *Pac Baroness* sank on September 21, resulting in a release of approximately 386,400 gallons (9,200 bbl) of oil and quantities of copper ore over the next 20 days. The rough weather contributed to slick areas covering upwards of four square miles (10.4 square kilometers [km^2]).

On November 7, 2007, container vessel *Cosco Busan* struck the delta tower of the San Francisco Bay Bridge causing damage to the vessel. The spill was estimated at 54,600 gallons (1,300 bbl). Oil traveled extensively within the San Francisco Bay as well as transiting as far as 17 miles (27.4 km) from the accident location outside the Bay. U.S. Coast Guard reports indicate that by November 14, clean-up efforts were transitioning from water recovery to shoreline recovery.

In addition to incidents along the California coast, a number of worldwide spill incidents involve releases of crude oil in similar nearshore situations as the proposed Project might experience. On December 7, 2007, a barge carrying a crane hit the single-hulled oil tanker *MT Hebei Spirit* six miles (9.7 km) off the west coast of South Korea, when the line between the barge and the tug towing it broke. The collision resulted in an estimated spill of 3.8 million gallons (90,000 bbl) of Iranian light crude oil, which impacted more than 90 miles (144.8 km) of shoreline within 10 days (United Nations 2007).

Spill Rates

Spill rates are defined as the number of spills per unit of activity. Most spill rates are defined as the number of spills per vessel call, per 1,000 vessel calls, or as the number of spills per unit length of pipeline per year. However, the BOEMRE defines spill rates based on the volume of material handled, or spills per billion bbl transported.

Vessel Spill Rates

Table 4.1-6 contains estimates compiled by a number of different studies that address potential spill rates within the southern California region, at marine terminals, and at the Project site.

The USCG compiles information on the number and size of spills that are great enough to produce a sheen (as per 33 CFR and 40 CFR 110) that occur annually within U.S. waters (USCG 2004, 2009). The resultant database includes spills from vessels in transit as well as those that occur while vessels are at port. This spill information was combined with U.S. Department of Transportation (USDOT) maritime data on the number of port calls at all U.S. ports to generate a spill rate (USDOT 2008).

Similarly, an updated CSLC evaluation of marine terminal oil spills shows that the rate of oil spills for California marine terminals between 1994 and 2006 ranged from a high of six per 1,000 transfers to a low of two per 1,000 transfers (CSLC 2007).

The BOEMRE estimates spills based on the volume of material handled. The BOEMRE spill rate per billion gallons handled was combined with the estimates of the amount of material handled at the Marine Terminal over the time period from 1977 through 2002, along with the estimated number of Marine Terminal calls during that time period, to generate a spill rate per 1,000 calls as a comparison to the CSLC and USCG spill rates. These are also shown in Table 4.1-6.

Table 4.1-6
Vessel Accident Rates
Spills per 1,000 Calls

Study/ Source	Years, Range	Ships/Conditions Involved	Spill rate
Regional Spill Rates			
CSLC	1994-2006	Ships, CA Waters	2 to 6
USCG	2002-2006	All vessels, US Waters	30
USCG	2002-2006	Tankers, US waters	9.1 all spills
			8.4 < 1,000 gallon
			0.7 > 1,000 gallon
			0.14 > 50,000 gallon
USCG	2002-2006	Tankers, US West Coast (CA, OR, WA)	4.9
POLA	2002-2005	All vessels, San Pedro bay area	44
El Segundo Marine Terminal Historical Rates			
BOEMRE, spills	1977-2002	Tankers, specific to El Segundo	0.19 > 42,000 gal
Marine Terminal	1977-2002	Tankers (Table 4.1-3)	8.5 all spills
			8.0 < 1,000 gallon
			0.41 > 1,000 gallon
			0.14 > 50,000 gallon
Lightering Operations			
Marine Board	1972-1997	Chevron Shipping, U.S. waters lightering	0.30 all spills
			0.023 > 1,000 gallon
			0.0045 > 50,000 gallon
Pipeline Spill Rates			
CSFM	1981-1990	Onshore and offshore pipelines leaks per 1,000 mile years	7.1, all spills
			9.89, crude oil, all spills
			1.78, crude oil, > 4,200 gal
USDOT	1968 -2000	Onshore and offshore pipelines leaks per 1,000 mile years	0.89 crude oil > 2,100 gal
CCPS	-	Leaks from hoses	0.11 leaks per hose-year

Notes: BOEMRE spills rate calculated based on average crude throughput and average number of vessel calls between 2000 and 2006. Larger lightering spills rate based on all spills rate with USCG spill distribution applied. Lightering spills based on volume of materials handled, estimated number of lightering operations, and an average spill size of 1,092 bbl as per Marine Board 1999. Hose rate assumes annual maintenance.
Source*:* CSLC 2007, USCG 2004, USCG 2009, Marine Exchange 2008, Anderson and LaBelle 2000, USDOT 2008, Marine Board 1998b, USDOT 2004, CSFM 1993, CCPS 1989

The history of spills at the Marine Terminal (see Table 4.1-3) and the estimated number of vessel calls from 1977 through 2002 were used to generate a spill rate for the Marine Terminal based on historical spills. Both the USCG and the historical Marine Terminal rates are categorized by spill size in Table 4.1-6. Although only a few large spills have occurred at the Marine Terminal since 1977, the USCG and the historical Marine Terminal rates are very similar.

Accidents and incidents during bunkering, lightering, and loading operations are responsible for approximately 57 percent of tanker spills (Etkin 2001). Unloading spills are generally small given the manned nature of the activity and presence of observation personnel in the immediate vicinity of the unloading operations. Statistics on worldwide accidental oil spills by oil-cargo (e.g., tanker ships, tank barges, and combination oil-cargo and non-oil-cargo) vessels collected by the International Tanker Owners Pollution Federation from 1974 to 2004 reveal that 54 percent were transfer spills, 21 percent were vessel-accident spills, and the remaining 25 percent were of unknown origin (ITOPF 2007). Of the transfer spills, 34 percent were directly related to loading and unloading operations. Regardless of their cause, the vast majority (84 percent) of the spills were relatively small, 2,100 gallons or less.

Pipeline Spill Rates

Table 4.1-3 indicates that approximately 10 spills between 1977 and 2002 were due to releases from the loading hose at the Marine Terminal. Since the CSLC spill rate and, to a certain extent, the USCG and BOEMRE spill rates, may already include some spills from pipelines, presenting a spill rate for the pipelines separately would involve some overlap of spill rates. In this EIR, a spill rate and frequency for the Marine Terminal pipelines has been calculated separately to provide an indication of the spill risks associated with the pipelines as opposed to those associated with vessels and loading hoses.

While pipelines historically have had one of the lowest spill rates of any mode of oil transportation, there is still some level of risk that a pipeline could leak or rupture. In order to estimate the frequency of such an event, historic data for other operating liquid pipelines have been used and are included in Table 4.1-6.

Historically, spills from pipelines have been attributed to a number of different causes, including corrosion; defects in material or welding; damage from third-party interference; natural hazards, such as earthquakes or landslides; and operational errors. Information on the number and causes of pipeline spills in the U.S. greater than 2,100 gal (50 bbl) in size is available from the USDOT Office of Pipeline Safety (USDOT 2004). These data were obtained for spills occurring from 1968 to 2000 for crude oil-only pipelines, as well as for all liquid pipelines. In the years since 1985, crude oil has comprised 42 to 51 percent of the liquid spilled from pipelines, and petroleum products have comprised 47 to 55 percent of the total volume spilled. Spills caused by corrosion rank as the most frequent cause, with an estimated 39 percent of all failures since 1985. The number of annual spills due to corrosion has remained in the same range since 1985, from a high of 36 and 35 spills in 1987 and 1996, respectively, down to eight spills in 2000. The number of spills due to third-party impact ranks next, with 30 percent of the spills. The overall spill rate of crude oil pipelines with spill volumes greater than 2,100 gallons (50 bbl) was estimated 0.89 spills per 1,000 mile-years (0.53 spills/1,000 km-years).

A California State Fire Marshall (CSFM) report, Hazardous Liquid Pipeline Risk Assessment, analyzes leak information for the 7,800 miles (12,552.9 km) of liquid pipelines within California for the years 1981 through 1990 (CSFM 1993). This study adjusted pipeline spill rates based on variables such as pipeline age, diameter, and operating temperature, as well as spill cause. The study found that external corrosion was the major cause of pipeline leaks, causing approximately 59 percent of spills, followed by third-party damage at 20 percent. Older pipelines and those that operate at higher temperatures had significantly higher spill rates. The CSFM base rate for crude oil pipeline spills of any size and operating conditions was calculated to be 9.89 incidents per 1,000 mile-year (6.1 incidents per 1,000 km-year). Crude oil had the highest spill rate primarily due to the transportation of crude oil at elevated temperatures, which increases the rate of external corrosion. Faster corrosion rates occur at elevated temperatures when metal comes in contact with soil moisture.

Spill frequencies were estimated in this report using information on crude oil pipeline spill rates available from the CSFM report. Although the CSFM study does not include very many offshore pipelines or pipelines that operate in batch mode (some pipelines in the CSFM report most likely do operate in batch mode, but the failure rate for these pipelines was not detailed), the CSFM data are considered to be the most conservative of the databases available (i.e., most protective of the environment). However, the CSFM indicates that the rates identified are generally higher than those identified in other studies.

Pipelines that operate offshore are exposed to a more extreme environment (i.e., more corrosive) and different set of third party impacts (e.g., boats, anchors) than onshore pipelines and might be expected to have a higher failure rate. However, spill rates estimated from BOEMRE information indicate that offshore rates are similar to, if not less than, the CSFM rates described (MMS 2000, Anderson and LaBelle 1999). In this study, the CSFM rates have been used to ensure a conservative estimate.

The CSFM report presents a set of hazardous liquid pipeline incident rates for all pipelines and uses. A review of the CSFM report shows that the following pipeline design and operation parameters can have a significant effect on pipeline spill rates:

- Pipeline age;
- Pipeline diameter;
- Pipe specification and type;
- Operating temperature;
- Supervisory Control and Data Acquisition System (SCADA);
- Cathodic protection system;
- Coating type; and
- Internal inspection program.

Using the CSFM data and the criteria listed above, pipeline leak and rupture rates were calculated for the offshore pipelines. Spill rates from the hose connections were estimated based on Center for Chemical Process Safety rates for leaks from hoses (CCPS 1989). Table 4.1-7 shows spill rates for both pipelines and hoses.

Lightering Spill Rates

Existing operations at the Marine Terminal include lightering of very large crude carrier (VLCC) and ultra large crude carrier (ULCC) class vessels offshore. Lightering involves the offshore transfer of cargo from large vessels, such as VLCC and ULCC that are too large to approach the El Segundo Marine Terminal or other terminals due to water depth, to smaller vessels that can approach and unload at the Marine Terminal or other area terminals. Annually, an average of 46 VLCC vessels lighter to approximately 87 smaller vessels for subsequent delivery to the Marine Terminal.

The Marine Board conducted studies on the spill risks associated with lightering in U.S. waters (Marine Board 1998b). Historical data on lightering operations along the west coast indicate that no spills were recorded during the approximately 272 lightering operations conducted by Chevron Shipping between 1972 and 1997. Similarly, during a total of 1,487 inshore lightering operations conducted by British Petroleum (between 1987 and 1997) and ExxonMobil (between 1992 and 1997) along the west coast, only 210 gallons (five bbl) were reportedly spilled. Chevron's lightering experience throughout all U.S. waters between 1970 and 1997 totals 5,322 lightering operations moving a combined total of 1.95 billion bbl of oil with a total of only 420 gallons (10 bbl) spilled.

Current Marine Terminal Operations Spill Rates

Based on the above spill rates, the frequency of spills at the Marine Terminal can be estimated for both existing and future operations. Table 4.1-7 shows spill frequencies and time between spills on a per year basis for the existing Marine Terminal operations using the USCG spill rates and the spill rates based upon the Marine Terminal history of spills between 1977 and 2002. The two spill rates (USCG and the historical calculations) are very close, with an estimated time between any sized spill of approximately four to five months and an estimated time between large spills (greater than 1,000 gallons [24 bbl]) of 4.2 to 7.0 years. The USCG database also presents information on the spill size distribution, which allows an estimate of spill sizes larger than 50,000 gallons. Spills greater than 50,000 gallons (1,190 bbl) are estimated to occur every 21 years. Spills associated with lightering operations contribute to only a small fraction of the overall spill risk.

Note that the USCG spill rates include both spills from vessels located at ports/berths and from vessel while in transit in U.S. waters. The spill rate associated with the Marine Terminal historical spills are only associated with spills at the Marine Terminal. Both estimates are shown in order to present a range of frequencies.

Spill frequency at the onshore areas of the Marine Terminal is a function of the length of piping and the equipment arrangement (e.g., number of pumps, valves). As the equipment and piping would not be expected to change with the proposed Project, these spill frequencies have not been quantified in this report.

Table 4.1-7
Marine Terminal Baseline Spill Frequencies

	Spill Rate, per 1,000 Transits	Spill Frequency, Spills per year	Time between Spills
USCG Spill Rates – Vessels			
Spill, Any Size	9.1	3.2	3.8 months
Less than 1,000 gallons (24 bbl)	8.4	2.9	4.1 months
More than 1,000 gallons (24 bbl)	0.7	0.24	4.2 years
More than 50,000 gallons (1,190 bbl)	0.14	0.047	21.2 years
Historical Spill Rates – Vessel and Terminal Activities at the Marine Terminal			
Spill, Any Size	8.50	2.9	4.1 months
Less than 1,000 gallons (24 bbl)	8.00	2.8	4.3 months
More than 1,000 gallons (24 bbl)	0.41	0.14	7 years
More than 50,000 gallons (1,190 bbl)	0.14	0.05	20.6 years
Lightering			
Spill, Any Size	0.3	0.01	71 years
More than 1,000 gallons (24 bbl)	0.023	0.001	935 years
More than 50,000 gallons (1,190 bbl)	0.0045	0.0002	4,753 years
Pipelines (spill rate in spills per mile-year or spills per year for hoses)			
Pipelines - Spill Any size	0.025	0.22	4.5 years
Pipelines - More than 2,100 gallons (50 bbl)	0.004	0.04	25.0 years
Hoses - Spill Any size	0.22	0.33	3.0 years
Hoses - More than 2,100 gallons (50 bbl)	0.02	0.03	30.0 years

Notes: based on 347 vessel visits per year

Spill Impact Modeling

This section describes the general methodology used to estimate the potential effects and extents (areas that could be impacted) of hypothetical oil spill scenarios. Following is a general description of the scenarios themselves and a summary of the results. Modeling results are presented in detail in Appendix C, Oil Spill Modeling. That appendix shows figures and tables related to specific hypothetical oil spill scenarios, which produce trajectories based on winds and currents, as well as the individual properties of the spilled material. As winds change over time, many figures in Appendix C, Oil Spill Modeling, have an odd, trajectory-type shape. These trajectory figures represent up to 1,000 modeling runs with different meteorological and ocean current conditions that were cumulatively combined to produce the probabilities of impacts figures for this section.

The computer model, SIMAP (Spill Impact Model Analysis Package), was used to evaluate potential impacts of releases of crude oil and diesel products for the SCB area, including Santa Monica Bay. The SIMAP was derived from the physical fate and biological effect sub-models in the Natural Resource Damage Assessment Model for Coastal and Marine Environments, which were developed for the U.S. Department of the Interior (DOI) as the basis of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 Natural Resource Damage Assessment regulations for Type A assessments (French et al. 1996).

The SIMAP contains physical fate and biological effect models, which estimate exposure and impact on each habitat and species (or species group) in the area of the spill. Inputs include hourly wind speed and direction data, which are used to generate wind-driven currents, and other (background) current data. The sum of these currents is used to transport oil components and organisms in the model domain. Environmental, geographical, physical-chemical, and biological databases supply required information to the model for computation of fates and effects. The technical documentation for the model has been compiled by French McCay (2003, 2004, 2009). The model has been validated with more than 20 case histories, including the Exxon Valdez and other large spills (French and Rines 1997; French et al. 1997; French McCay 2003, 2004; French McCay and Rowe 2004), as well as test spills designed to verify the model (French et al. 1997).

The model is composed of a number of different parts, including a physical fates model and a biological effects model. The physical fates model determines where the spill might go as a function of winds and currents. The biological effects portion assesses the concentrations of the oil and its associated properties as the spill disperses and what effects these might have on biological resources.

Spill impact modeling has been conducted for offshore areas only. Spill consequences and spill volumes at the onshore areas of the Marine Terminal are a function of the length of piping and the operations, such as pumping rate. A spill at the Marine Terminal onshore areas could flow offsite and impact the beach areas or could flow into storm drains that potentially flow to the ocean or wastewater treatment facilities. A site visit to the onshore Marine Terminal areas indicated that a spill in the immediate areas around the pumps would be contained by depressed areas. However, drains in these depressed areas might flow to the environment. Areas away from the depressed pump areas are generally not bermed, and pipe leaks or ruptures in these areas could flow to the beach. Spill volumes would be a function of the pumping rates, vessel and piping volumes, and the duration a leak goes undetected. Spill volumes would be approximately 3,750 bbl (157,500 gallons) for a five-minute leak on the Berth 4 pipeline.

Physical Fates Model

The physical fates model estimates the distribution of oil, as mass and concentration, on the water surface, on shorelines; in the water column; and in the sediments. Processes simulated include slick spreading, evaporation of volatiles from surface oil, transport on the surface and in the water column, randomized dispersion (i.e., caused by turbulence), emulsification (formation of mousse), entrainment of oil as droplets into the water, surfacing of droplets, dissolution of soluble components, volatilization from the water column, partitioning (adsorption of a portion of the semi-soluble compounds onto suspended material from the dissolved state), sedimentation, stranding on shorelines, and degradation. Oil mass is tracked separately for lower molecular weight aromatics (1- to 3-ring aromatics), which are water soluble and, therefore, cause toxicity to aquatic organisms, other volatiles, and non-volatiles (French McCay 2002, 2003, 2004; French et al. 1996).

'Whole' oil (containing non-volatile and volatile components not yet volatilized or dissolved from the oil) is simulated as floating slicks, emulsions, and tarballs, or as dispersed oil droplets of varying diameter (some of which may resurface). Sublots of the spilled oil are represented by so-called Lagrangian elements (spillets), each characterized by the mass of hydrocarbon components and water, location, thickness, diameter, density, and viscosity. Spreading (gravitational and by transport processes); emulsification; weathering (volatilization and dissolution loss); entrainment; resurfacing; and transport processes determine the thickness, dimensions, and locations of floating oil over time. The output of the physical fates model includes the location, dimensions, and physical-chemical characteristics over time of each spillet representing the oil (French McCay 2003, 2004).

Biological Effects Model and Indices of Exposure

The biological effects model in SIMAP estimates the area, volume, or portion of a biological resource affected by surface oil, concentrations of oil components in the water, or sediment contamination (French McCay 2003, 2004). Section 4.3, Biological Resources, discusses additional information on the biological effects.

Stochastic Model

To determine the consequences of hypothetical spills on ecological resources, multiple scenarios and conditions were evaluated to estimate the probability and likely amount of oil reaching sites of concern. The stochastic oil fates model in SIMAP is used to determine the range of distances and directions oil spills are likely to travel from a particular site, given historical wind and current speed and direction data for the area. To sample the universe of possible environmental conditions, long-term wind and current data were compiled. For each model run used to develop the statistics, the spill date is randomized, which provides a probability distribution of wind and current conditions during the spill. The stochastic oil fates model performs a large number of simulations for a given spill site, varying the spill time, and thus the wind and current conditions, for each run. Output of the model is the time histories of the spill trajectories. These distributions are used to estimate the percent of these hypothetical spills where water surface, water column, sediments, and shoreline areas would be affected by a release from a spill at a given site, as well as the amount of oil exposure that would occur for each of the model runs.

Spill Scenarios and Fates

This section describes the potential for spills and discusses the geographical areas that would be covered by a spill under various conditions. Subsequent sections involving resource areas, such as Sections 4.2, Water and Sediment Quality; 4.3, Biological Resources; and 4.7, Land Use, Planning and Recreation, address the consequential impacts associated with these spills.

The purpose of a scenario analysis is to analyze how a particular spill would behave over a period of time. The analysis is representative for a specific set of conditions, depicting the movement of oil over time and the area impacted. Response effectiveness can then be evaluated against the output from the scenario analysis. It should be noted that modeling neither covers every type of potential spill nor accommodates all potential movements of a particular spill. The modeling effort is intended to identify the range of potential impacts associated with various sizes of oil spills, emphasizing the potential impacts under the prevailing conditions, to assess the effects of maximum, worst case conditions, and to assess compliance with Federal and State regulatory requirements.

Spill scenarios and fates are generated for a spill from the Marine Terminal equipment (i.e., pipelines) at the Marine Terminal and for spills from vessels.

Marine Terminal Spill Analysis – Scenarios and Impacts

Previous modeling efforts considered spill scenarios at the Marine Terminal, ranging from spills of 500 to 1.1 million bbl. In that effort, an earlier version of the SIMAP oil spill model was used, along with input data available at that time. Over the last decade, the oil spill model has been updated with new information and more sophisticated algorithms, such as the capability to track more of the components of the oil separately in three-dimensional space and time, leading to greater accuracy in the results. In addition, considerably more detail is now available for mapping and quantifying biological and shoreline resources, and those new data sets are used in the present analysis. The oil types and properties have also been updated to reflect current information and oils being imported to the Refinery. Finally, the approach for selecting scenarios to be examined in the present study was based on a probabilistic analysis of hundreds of model runs for each scenario examined, which provides a quantitative and objective assessment of worst-case weather conditions for producing impacts. In the 1996 modeling work, mean and Santa Ana winds were assumed constant in speed and direction for simulations under those weather conditions; although a real wind pattern for a sample storm was used for the storm-condition scenarios. In the present modeling, actual wind speed and direction data that would cause the highest potential impacts were selected for detailed analysis. Thus, the present analysis is based on the worst-case, whereas the 1996 analysis examined representative spill cases.

For pipeline spills and operational releases at the Marine Terminal, effects of releases at either Berth 3 or Berth 4 would be similar. For this reason, a mid-point between them is used as the spill location. Slight variations of the spill site in this vicinity would not noticeably affect the model results.

Spills associated with the Marine Terminal operations assumed a worst-case release of the entire pipeline contents or a smaller volume equal to 1,000 bbl, as was conducted in the 1996 EIR. The larger spills include an 11,000 bbl spill from the pipelines associated with transferring lighter products, such as diesel fuel, with pumping from the vessel to the Refinery and a 12,090 bbl spill from pipelines while transferring crude oils with pumping from the vessel to the Refinery, which are the worst-case spills from the pipelines in the 1996 EIR. Table 4.1-8 summarizes the various spill scenarios.

Table 4.1-8
Marine Terminal Spill Scenarios

Scenario: Size	Diesel	Light Crude	Heavy Crude	Release Time[1]
Pipeline spills: 1,000 bbl	Modeled*	Modeled*	Modeled*	0.5 hr
Pipeline spill: 11,000 bbl (at ship coupling, 26-inch pipe; entire pipeline volume lost), Berth 3	Modeled	Not Modeled	Not Modeled	1.5 hr
Pipeline spill: 12,090 bbl (at ship coupling, 36-inch pipe; entire pipeline volume lost), Berth 4	Not Modeled	Modeled	Modeled	0.9 hr

Notes: * Analyses of impacts for these three scenarios were made for the worst case runs based on the 11,000 bbl diesel and 12,090 bbl light or heavy crude terminal spill results by running the scenarios with a volume of 1,000 bbl.
For all scenarios, release depth is assumed to be at the water surface.
[2] The terminal spill release duration is that modeled in the previous EIR, and is a reasonable time for operational spills where operators would shut off valves or otherwise mitigate the problem to stop the release in this time frame. The pipeline spill release durations in the modeling are based on a flow rate out of the pipe of three feet per second, a reasonable rate for the size pipeline used.

In the analysis, SIMAP was first run in stochastic mode to estimate probabilities and degrees of oil exposure for each location affected by a spill under a range of possible environmental conditions that could occur at the Marine Terminal. These stochastic scenarios were used to determine probabilities of oil reaching various locations and to select worst-case runs for further study. Analysis of impacts for smaller-volume scenarios (in the same locations and with the same oil type) were made for the worst-case runs based on the larger volume spill results by running each scenario with a smaller volume (1,000 bbl).

Temperature, salinity, and other environmental conditions were varied monthly, based on data compiled by French et al. (1996). A ten-year wind record was sampled at random to develop a probability distribution of environmental conditions that might occur at the time of a spill. Data from the National Data Buoy Center Buoy 46025, in the Santa Monica Basin, were used for all scenarios.

Although pipeline ruptures could physically occur at any location along the pipeline, the potential causes of such accidents (such as the 1991 Omi Dynachem release) would be greatest farther from shore where greater ship traffic occurs. The potential effects would also be greatest from a pipeline rupture farther offshore since a nearshore rupture might be more quickly contained thereby affecting less shoreline. Therefore, as a worst case, the pipeline ruptures in the model were located at the berths.

Since oil density largely controls the fate and impacts of discharged oil, the modeling design was to run crude oil types spanning the range of crude oil densities (i.e., the American Petroleum Institute [API] range) that might be refined at El Segundo in the future. The two crude oils that were modeled were Arabian light crude (API = 33) and Napo heavy crude (API = 19). Diesel oil spills were also modeled to evaluate spills of products shipped from the Marine Terminal. Diesel is the product most likely to induce impacts on aquatic biota and shorelines, since it is less volatile and more toxic than products like gasoline.

To be consistent with other analyses and to represent worst case conditions, no response involving containment or cleanup of the spill using mechanical or chemical (dispersant) means was assumed to occur in any of the scenarios modeled. Such responses could reduce the impacts shown.

Based on the large number of modeling runs, the probability of different wind directions and speeds and the probability of ocean current speeds and directions, the probability of oil impacting a given location can be estimated.

The probability of surface floating oil exceeding the threshold of 0.01 grams per square meter (g/m^2) (the minimum thickness for a sheen) at a given location at any time following a spill was estimated for each of the Marine Terminal scenarios listed in Table 4.1-8. For surface oil, the model records if any oil greater than the threshold thickness passes through the model grid cell. Maps of the results summarizing all potential trajectories of each scenario are contained in Section C.3 of Appendix C, Oil Spill Modeling.

For the modeled 12,090-bbl Arabian light crude spills at the Terminal, the probabilities of impacting a given area are shown in Figure 4.1-1. Areas that could be impacted by a spill include the Santa Monica Bay, the Santa Barbara Channel, and Channel Islands to the west, and San Nicolas and Catalina Islands to the south. Under very specific wind conditions, oil could even travel as far south as San Diego.

However, the highest probability of shoreline oiling in any season would occur in very close proximity to the Marine Terminal pipeline along the Santa Monica Bay directly to the east of the Marine Terminal. Under eastward wind conditions, up to 50 to 70 percent of the spilled oil would be deposited on the shoreline.

The northern Santa Monica Bay area near Malibu would have a somewhat lower probability of being oiled than areas in the southern portion of the Bay due to the prevailing current patterns (see Section 4.2, Water and Sediment Quality).

For the December to May period, during the Santa Ana wind conditions, released oil would likely be carried offshore towards the south or to the southwest with a substantial portion of events eventually affecting the Channel Islands.

For the June to November period, released oil could also be carried towards the Santa Barbara Channel, but slightly more to the north and without as much of a southerly component.

Figure 4.1-1 shows areas that would be potentially affected by light crude oil spills. While the releases of diesel and heavy crude from the Marine Terminal have similar extents of oiling as predicted for the light crude releases, the spatial extent of surface oil exceeding the threshold of 0.01 g/m^2 for the diesel cases is somewhat larger due to the increased spreading that would occur with diesel as opposed to crude oil. Similarly, heavy crude would not spread as far as light crude (see Figures C.3-1 and C.3-3 in Appendix C).

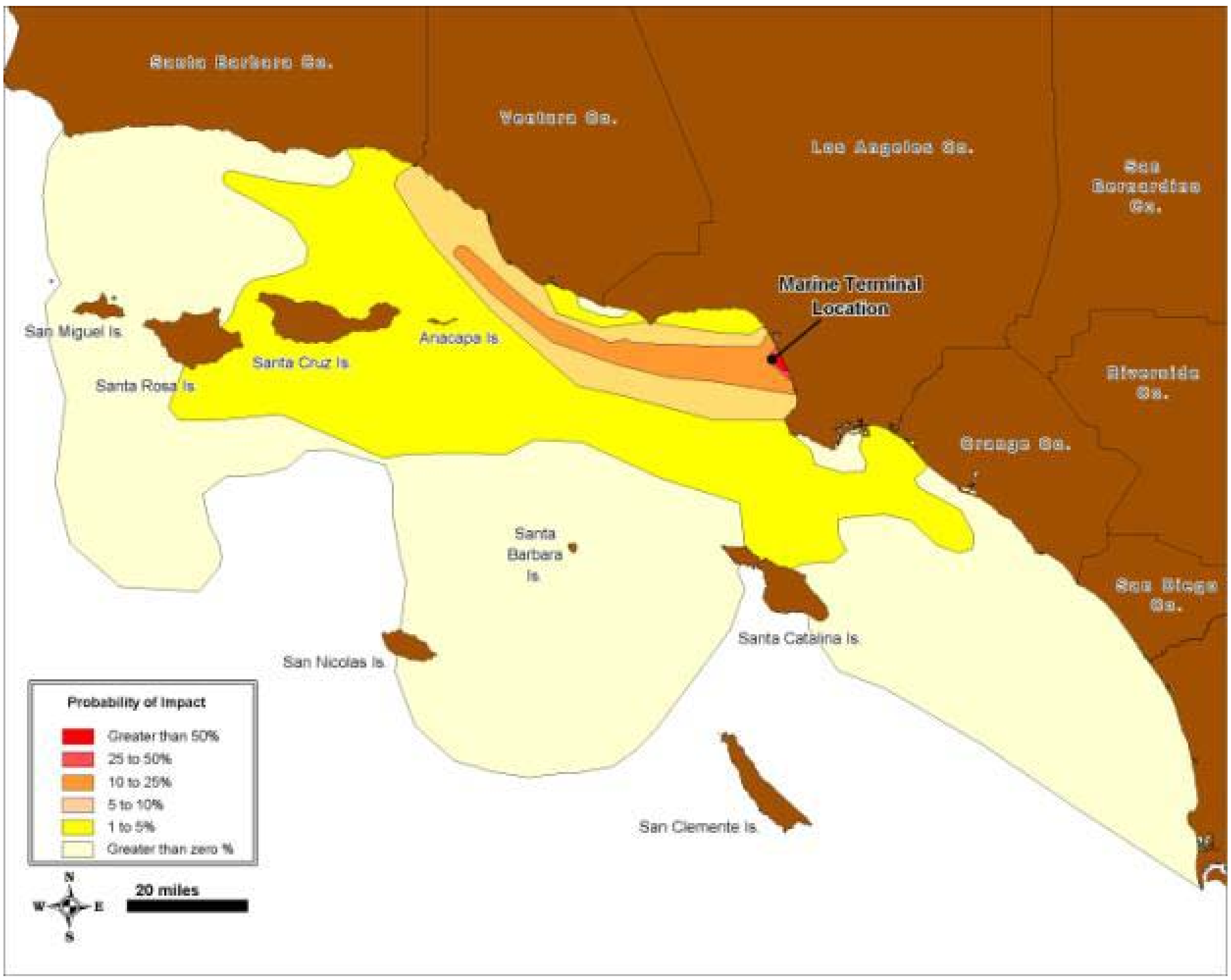
For the smaller pipeline spills at the Marine Terminal of 1,000 bbl diesel, the footprint would be the same as would be expected for the 11,000 bbl diesel spills; however, the expected maximum mass would be only nine percent of the larger spill. For the pipeline spills of 1,000 bbl light crude or heavy crude oil, the footprint would be the same as that shown for the 12,090 bbl light crude spills; however, the mass would be only 8.3 percent of the larger spills.

<u>Time Frame</u>

Although spills are generally controlled on the water within seven to ten days from occurrence, the trajectories analyzed to compile Figures 4.1-1 and 4.1-5 are based on a time elapsed from the spill of 30-plus days. This 30-day analysis was conducted in order to conservatively assess the worst case fate of oil spills. For perspective, additional figures demonstrate the anticipated time to impact for the leading edge of the spills. For example, Figure 4.1-2 shows the time-to-impact for the leading edge of the pipeline spills, indicating that, over a seven- to ten-day time frame, pipeline spills might be expected to impact Catalina Island to the south, Long Beach to the east and the Ventura county and Oxnard area to the west and north.

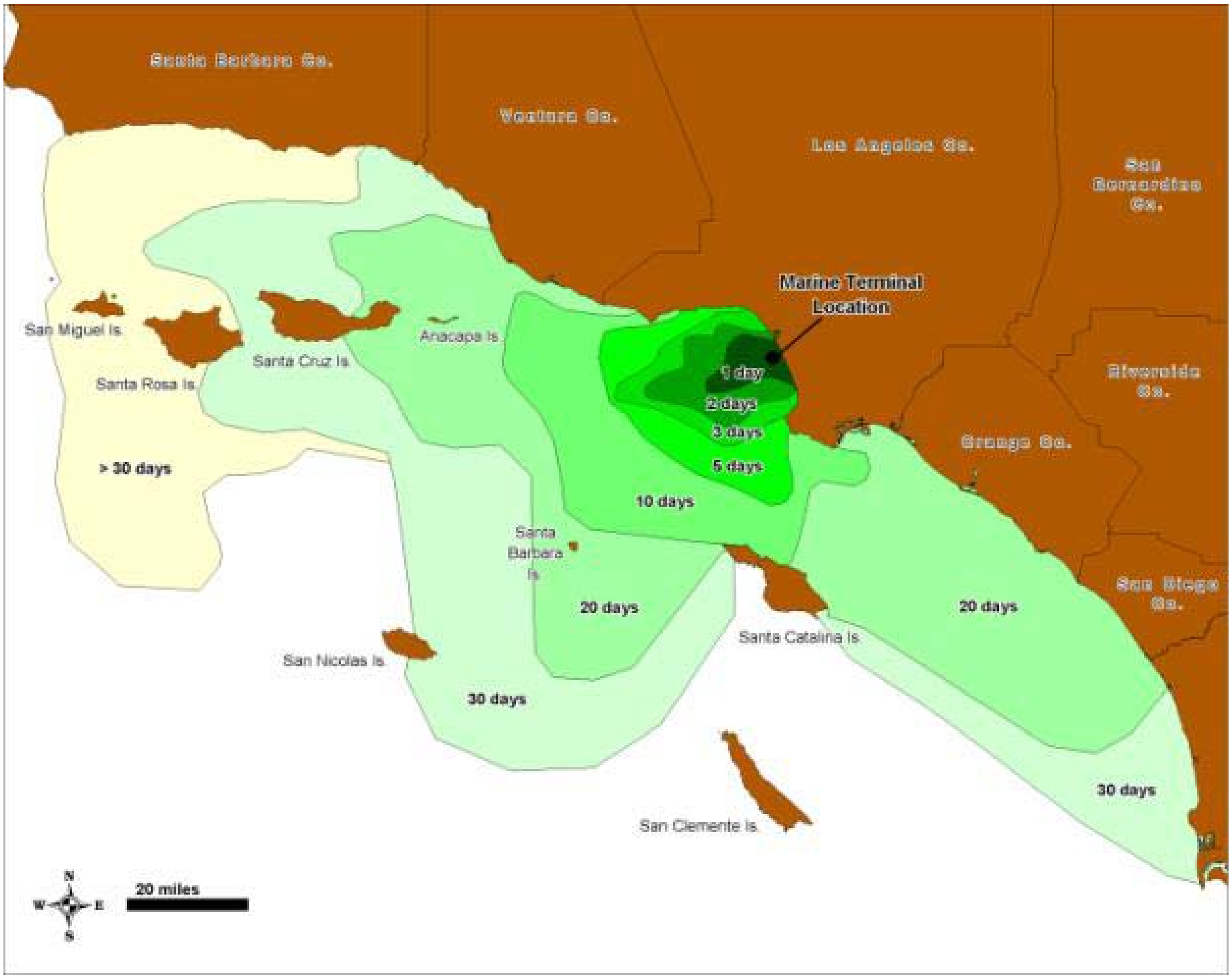
The Chevron Oil Spill Contingency Plan conducted modeling over a one- to three-day time frame (Chevron 2003). The results of the Chevron modeling indicated that, within one day, oil could impact the shoreline northward to Las Flores and southward to Point Vicente. Within three days, the spread of oil could affect shorelines north to Point Dume and south to Point Fermin. In other words, within three days, the Oil Spill Contingency Plan estimates that shoreline impacts would occur within the Santa Monica Bay and extend around the southern portion of the Palos Verdes Peninsula.

Figure 4.1-1
Probability of Oil Spill Impacts for Worst-Case Pipeline Spills



Notes: For light crude spills. Surface floating oil exceeding 0.01 g/m^2.

Figure 4.1-2
Time Frame of Worst-Case Pipeline Spills



<u>Individual Spill Scenario Impacts</u>

Figures 4.1-1 and 4.1-2 show the combined modeling runs, resulting in probabilities and time frames of oil impacts above a certain threshold at any area. However, an individual spill would impact only a subset of the areas shown in these figures. In order to give an indication of the area impacted by an individual spill, specific spill trajectories are shown in the following figures for an individual spill that could impact the mainland shoreline or the Santa Barbara Channel Islands.

Impact indices, such as water surface exposure to floating oil, were analyzed for each of the individual scenarios for the Marine Terminal spills. For each scenario, impacts were ranked for the following indices:

(1) area of water surface exposed to floating oil of various threshold thicknesses;
(2) water volume exposed to more than one part per billion (ppb) (one milligram per cubic meter) of dissolved aromatic concentration at some time after the spill (which is indicative of effects on water quality);
(3) exposure dose of dissolved aromatics (ppb-hours) in the water volume exposed to more than one ppb of dissolved aromatic concentration at some time after the spill (which is indicative of the potential for effects on zooplankton, fish, and invertebrates);
(4) percent of spilled hydrocarbon mass eventually going ashore;
(5) percent of spilled hydrocarbon mass settling to sediments (subtidal and extensive intertidal habitats); and
(6) maximum percent of spilled hydrocarbon mass in the water column at any time after the spill.

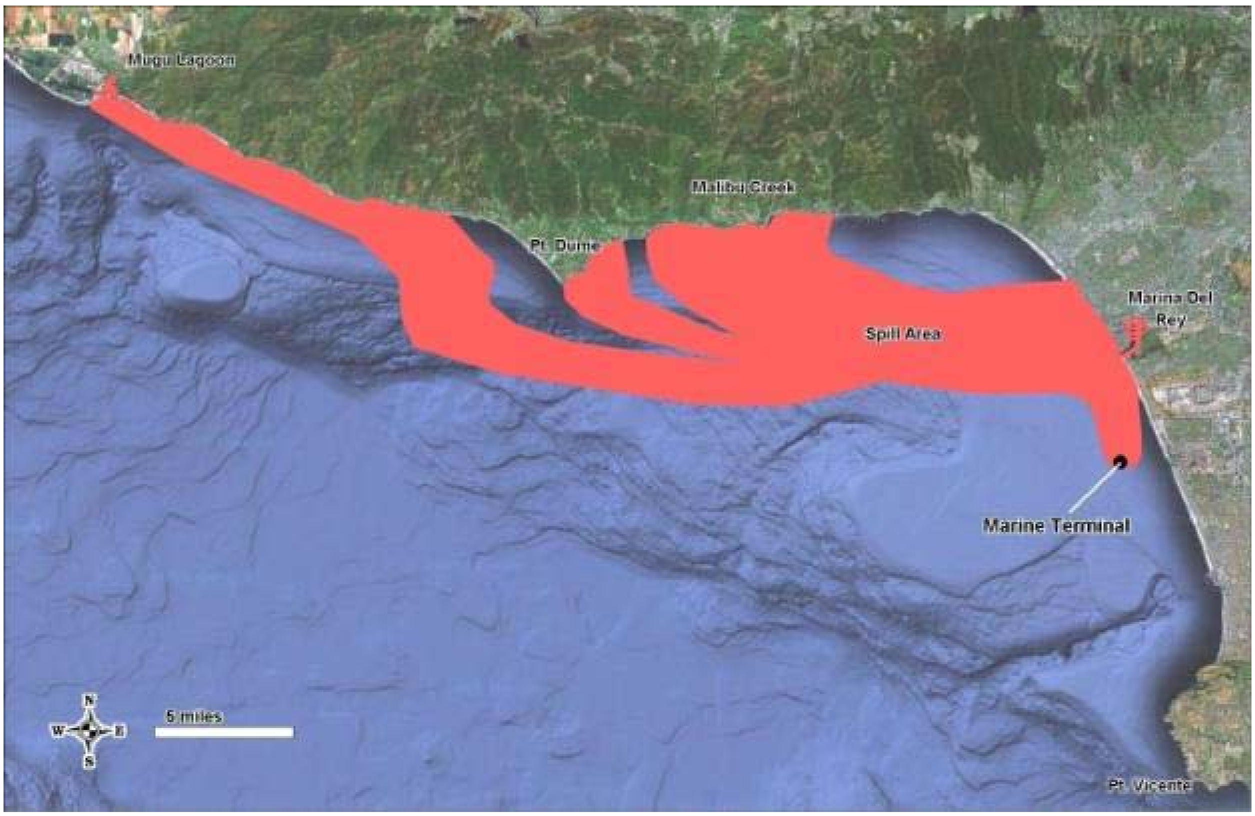
The results demonstrate that the variability in weather greatly affects the outcome of a spill. If a spill occurs during a storm that generates rough seas, there would be more entrainment (dispersion) of the oil into the water column and water column impacts would be higher while the extent of spreading of the oil slick would be less (i.e., less oil impacting the shoreline). The less viscous the oil, the more easily it would be dispersed into the water and the less oil that would eventually come ashore. Figures 4.1-3 and 4.1-4 show the worst-case individual spill impact to the mainland and the Santa Barbara Channel Islands.

A spill during strong wind would create worst-case impacts to the water, which could drive the oil directly into the shoreline eastward of the Marine Terminal and, due to the strong winds and associated wave action, would create the highest dissolved hydrocarbons, but a smaller area of impact.

The worst case impacts to the California mainland for Marine Terminal spills would be those in which oil moves towards the shoreline and then tangential to the shoreline depositing oil along beaches over a large area. The scenario that produced the heaviest shoreline oiling within 10 days of the spill occurred with a spill that moves as shown in Figure 4.1-3. Approximately 28 miles (45.1 km) of mainland beaches would be impacted by this spill. This spill scenario would impact Marine Del Rey, then westward to Malibu Creek, Point Dume, and as far as Mugu Lagoon.

For this case, the trajectories for diesel and heavy crude would follow a similar path, varying slightly based on the volume of oil released and the weathering properties of the different oils.

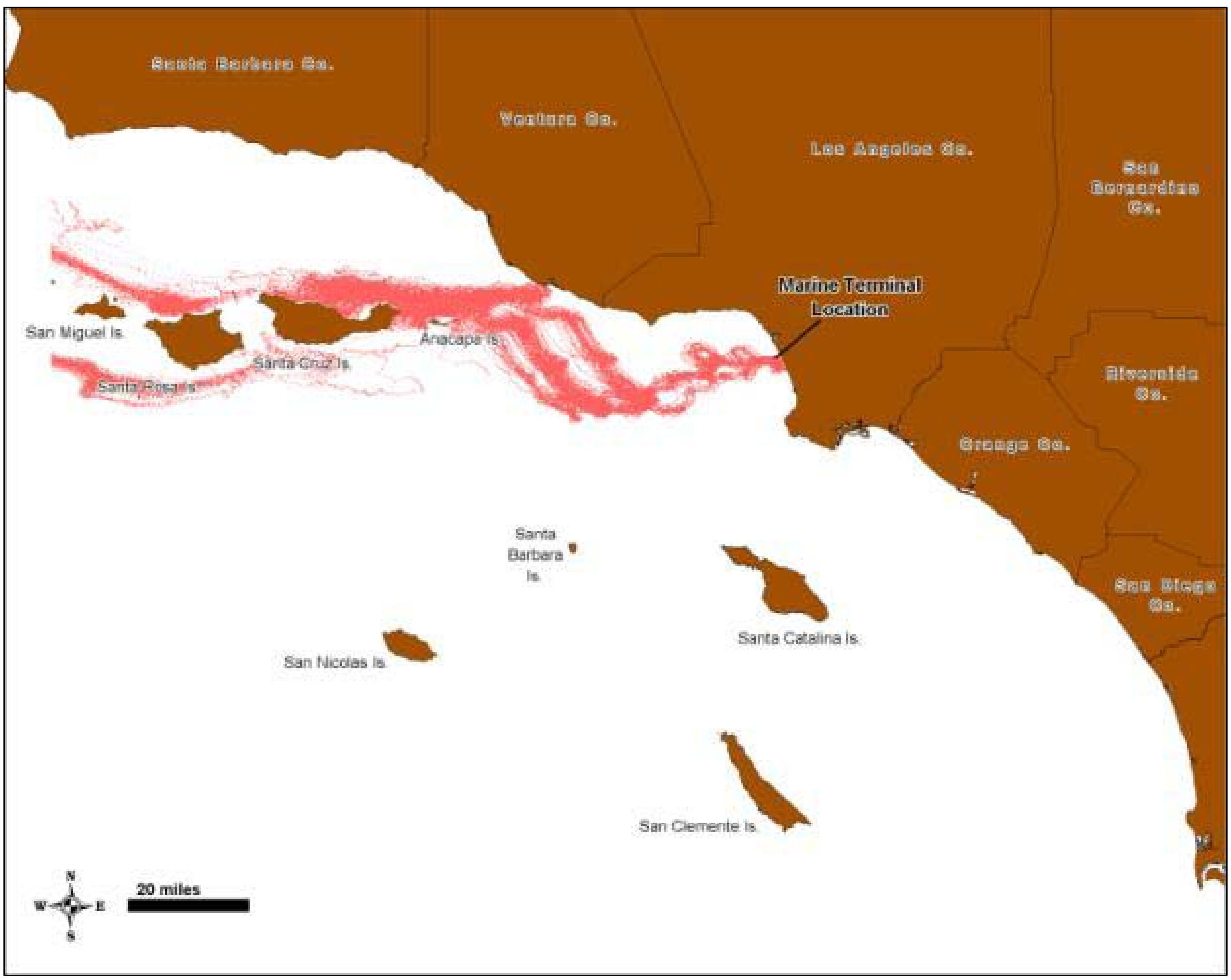
Figure 4.1-3
Worst-Case Impacts to the Mainland Shore from a Terminal Spill



The worst case conditions for spill impacts to the Santa Barbara Channel Islands would be those where oil moves in a westward direction from Santa Monica Bay towards the Santa Barbara Channel Islands and then onto the coasts of Anacapa, Santa Cruz, and Santa Rosa Islands (see Figure 4.1-4). As with the previous worst case scenario, the trajectories for the worse case impacts to the islands for diesel and heavy crude would follow a similar path (see Figures C.6-5 and C.6-25 of Appendix C). The time frame for impacts to Anacapa Island would be on the order of 20 days

The worst conditions for individual spill impacts to the water column would be those in which winds are strong enough to cause high entrainment into the water column. This usually would occur before a large area of water could be swept by surface oil and would occur in the immediate vicinity of the oil spill. Therefore, the footprints of these spill trajectories are much smaller than those for the worst cases to the mainland and the Channel Islands. Diesel spills would cause the most exposure to the water column because the viscosity of diesel is lower than more viscous crude oils (and heavier fuels) and the more volatile components would dissolve into the water column more quickly. Therefore, the time frame for impacts to the water column would be short, on the order of a few days at most.

Figure 4.1-4
Worst-Case Impacts to the Channel Islands from a Terminal Spill



The length of shoreline that could be impacted and the percentages of oil spilled that could come ashore for the worst-case individual spills are shown in Tables 4.1-9 and 4.1-10.

The lengths of shoreline oiled during Marine Terminal spills were determined based on total shoreline oiled at a specific threshold. The shoreline oiling results are affected by the wind conditions in the various cases. For instance, if a spill at the Terminal occurs during a period of northeastward directed winds, the oil would be driven directly onto shore, resulting in a greater area of shoreline oiled compared to a case where westward winds predominate and oil is driven offshore.

Generally, the heavier the oil, the thicker the oil would be onshore. However, although lighter, diesel oil spreads faster than crude oils. Therefore, if there is enough volume, diesel can oil a larger area of shoreline than crude oil but at a lower peak concentration.

Table 4.1-9 summarizes light oiling and heavy oiling. Light oiling would be equivalent to impacts on intertidal habitats of more than 100 g/m^2, which has been found to indicate adverse impacts to intertidal organisms, for the worst case runs of the modeled scenarios (French et al. 1996). Heavy oiling is defined as equivalent to more than 1,000 g/m^2. Note that the diesel spills of the same volume would impact the largest areas with light oiling, while the crude spills would impact the largest areas with heavy oiling due to their more viscous nature.

Model runs involving 1,000-bbl spills at the Marine Terminal were run for the same conditions as the 11,000-bbl diesel and 12,090-bbl crude spills. The trajectory path and timing for the 1,000-bbl diesel scenarios would look the same as those for the worst case 11,000-bbl diesel spill to the mainland, except the mass would be nine percent of the larger spill. The 1,000-bbl light and heavy crude scenarios would look the same as those for the worst-case 12,090-bbl light and heavy crude spill to the mainland, except the mass would be 8.3 percent of the larger spill.

Table 4.1-10 shows the worst case fates of the spilled oil in terms of the amount of the spill ending up on the shoreline, in the sediment (in subtidal and extensive intertidal habitats), and in the water column. These percentages are the worst-case percents encountered for all of the modeling runs. For example, the worst case for oil coming ashore would be associated with relatively calm weather with winds towards the shoreline while the worst case for the impacts to the water column would be associated with rough seas and high winds producing more mixing. Please see Appendix C, Oil Spill Modeling, for more details.

Table 4.1-9
Summary of Worst Case Shoreline Fate for Individual Terminal Spills

Scenario Name	Shoreline Length – Mainland, miles (km)	Shoreline Length – Islands, miles (km)
Lightly Soiled*, More than 100 g/m^2		
Diesel; 1,000 bbl	0.7 (1.2)	0 (0)
Light crude; 1,000 bbl	9.3 (15.4)	0 (0)
Heavy crude; 1,000 bbl	11.2 (18.7)	0 (0)
Diesel; 11,000 bbl	38.1 (63.6)	33.2 (55.3)
Light crude; 12,090 bbl	30.1 (50.2)	18.0 (30.0)
Heavy crude; 12,090 bbl	26.6 (44.3)	16.0 (26.7)
Heavily Soiled, More than 1,000 g/m^2		
Diesel; 1,000 bbl	0 (0)	0 (0)
Light crude; 1,000 bbl	3.4 (5.6)	0 (0)
Heavy crude; 1,000 bbl	4.1 (6.8)	0 (0)
Diesel; 11,000 bbl	5.2 (8.6)	0 (0)
Light crude; 12,090 bbl	18.7 (31.2)	8.4 (14)
Heavy crude; 12,090 bbl	21.7 (36.2)	12.1 (20.2)

Notes: * Lightly soiled equates to the threshold for impacts to intertidal species. See Appendix C.

Table 4.1-10
Worst Case Spill Fates for Individual Terminal Spills
Percent of Spill

Scenario Name	Coming Ashore	In Sediment	In Water Column
Diesel	28.3	25.6	31.9
Light crude	42.9	35.9	26.5
Heavy crude	66.1	4.5	43.1

Notes: Since the percentages are the worst case taken from the large number of modeling runs, they do not individually occur as part of the same spill scenario and therefore do not add up to 100 percent.

Tanker Spill Scenarios and Impacts

Table 4.1-11 describes the spill scenarios from vessels that were modeled for this EIR. In the 1996 EIR modeling analysis, 88,000-bbl and 380,000-bbl spills of crude oil were modeled, but the releases were always assumed to be at the Terminal. To consider spills that could reasonably occur from tankers or barges in transit to and from the Terminal, worst-case volumes for each of the three oil types (i.e., diesel, light crude, and heavy crude) were modeled, assuming random release points along the likely tanker routes between the Marine Terminal and the existing shipping lanes in northbound and southbound directions.

Table 4.1-11
Transit Vessel Spill Scenarios

Scenario	Location[2]	Diesel	Light Crude	Heavy Crude	Release Time[3]
Tanker: 2,500 bbl	Between terminal and shipping lanes	Modeled*	Modeled*	Modeled*	4 hrs
Tanker: 275,000 bbl[1]	Between terminal and shipping lanes	Modeled	Modeled	Modeled	4 hrs

Notes: * Analyses of impacts for these three scenarios were made for the worst case runs based on the 275,000 bbl transit spill results by running the scenarios with a volume of 2,500 bbl.
[1] This scenario is run in response to the SB 2040, which requires consideration of 'reasonable worst case spills' which are generally considered 25 percent of a vessel's cargo.
[2] For all scenarios, release depth is assumed to be at the water surface.
[3] The tanker spill release duration is based on review of spill data for large tanker spills and is the release time assumed in recent modeling studies (French McCay et al. 2006).

In the present analysis for this EIR, both medium (2,500 bbl) and large (275,000 bbl) volume spills were modeled. The worst-case spill volume modeled was 275,000 bbl, which is equivalent to 25 percent of the cargo volume of the largest vessel that could use the Marine Terminal. This is in response to the Lempert-Kenne-Seastrand Oil Spill Prevention and Response Act (Senate Bill [SB] 2040), which requires consideration of reasonable worst-case spills, generally considered 25 percent of a vessel's cargo.

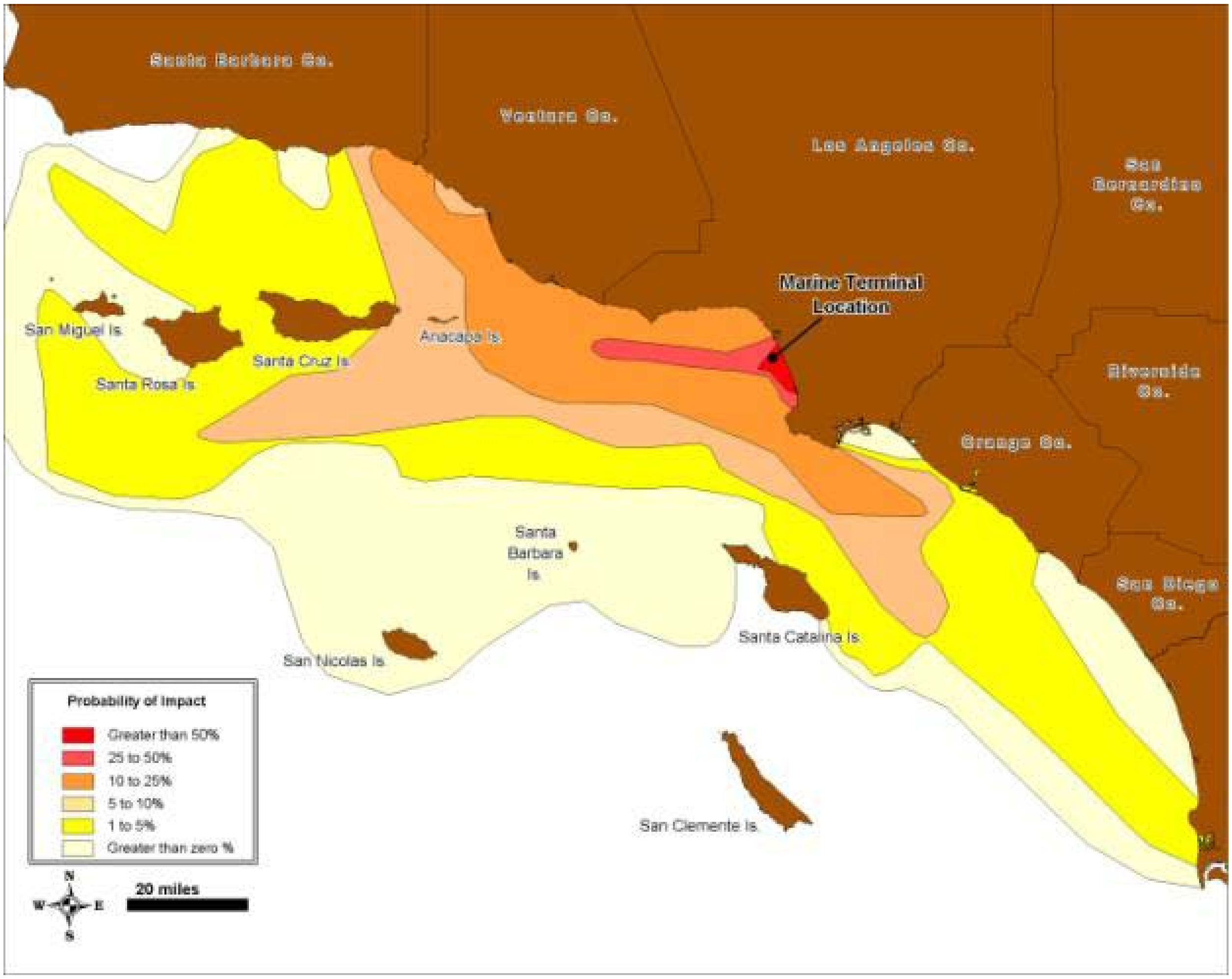
The USCG regulations define various spill sizes as a medium volume spill of 1,000 to 2,500 bbl, based on the maximum most probable discharge from a tanker, and a large volume spill of 40,000 to 100,000 bbl, as a likely worst-case discharge, which is typically the volume of two tanks of a tanker (33 CFR 155.1020). These volumes were used in a previous analysis that provided technical input to the Programmatic Environmental Impact Statement (PEIS) (French McCay et al. 2004, USCG 2004), which was prepared in support of the USCG's Notice of Proposed Rulemaking regarding Vessel and Facility Response Plan oil removal capacity requirements for tank vessels and marine transportation-related facilities (USCG 2002, 1999). The PEIS, in accordance with the National Environmental Policy Act of 1969, examines a series of alternatives, including a no action alternative, which could influence the availability of oil spill response equipment around the U.S. (USCG 2004). The proposed regulations would affect existing requirements for regulated vessels and facilities to contract for mechanical recovery, the use of dispersants, and the use of in-situ burning. Modeling was performed to evaluate consequences of various alternative requirements. Thus, the medium spill volume analyzed in the present EIR is similar to the volumes examined in the PEIS; however, the worst-case discharge of 275,000 bbl in the present EIR far exceeds the largest volume analyzed by the USCG.

According to data supplied by Chevron for 2006 through 2008, the largest cargo size delivered to the Marine Terminal was 44 million gallons (1.057 million bbl) and the largest vessel capacity was 56 million gallons (1.3 million bb).

The probability of surface floating oil exceeding the threshold of 0.01 g/m^2, the minimum thickness for a sheen, at any time following a spill was determined for each of the tanker scenarios. For surface oil, the model records if any oil greater than the threshold thickness passes through each model grid cell, regardless of the aerial coverage of the oil. Maps of the results summarizing all potential trajectories, with randomly selected spill dates, of each scenario are contained in Section C.3 of Appendix C, Oil Spill Modeling.

For the 275,000 bbl light crude spills from tankers transiting to or from the Marine Terminal, the estimated probability of impacting an area is shown in Figure 4.1-5. The December to May period is when easterly Santa Ana winds occur, which peak in December. Although those events are relatively low probability, they would carry oil directly offshore (west) towards the Channel Islands and could impact areas of Ventura county. The highest amount of oil impacting the shoreline in any season would be 40 to 50 percent of the spilled oil and would occur to the mainland portions of the Santa Monica Bay that are east of the Terminal site.

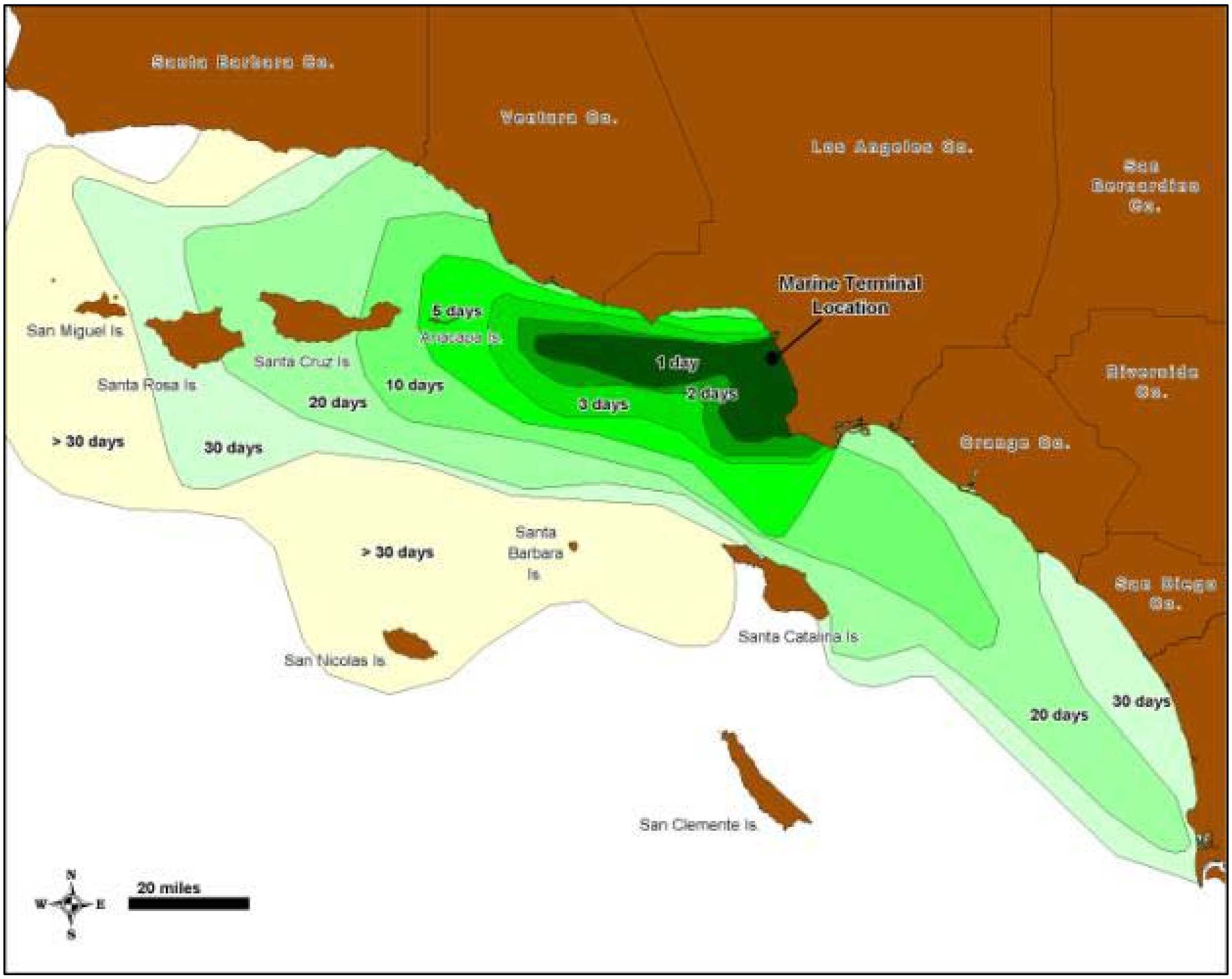
Figure 4.1-5
Probability of Spill Impacts for Worst-Case Tanker Spills



The release of 275,000 bbl of diesel and heavy crude occurring while transiting to or from the Marine Terminal would have a similar oiling extent as that shown for the light crude releases while in transit. Similarly, for the tanker spills of 2,500 bbl diesel fuel oil or light or heavy crude oil the footprint would be the same as that expected for respective 275,000-bbl spills of each fuel type; however the total mass would only be 0.9 percent of the larger spill.

Figure 4.1-6 shows the time-to-impact for the leading edge of the tanker spills, indicating that, over a five- to ten-day time frame, tanker spills might be expected to reach Anacapa Island, the eastern portions of Santa Cruz Island and Ventura county to the west and Long Beach to the south and they would almost reach Catalina Island to the south.

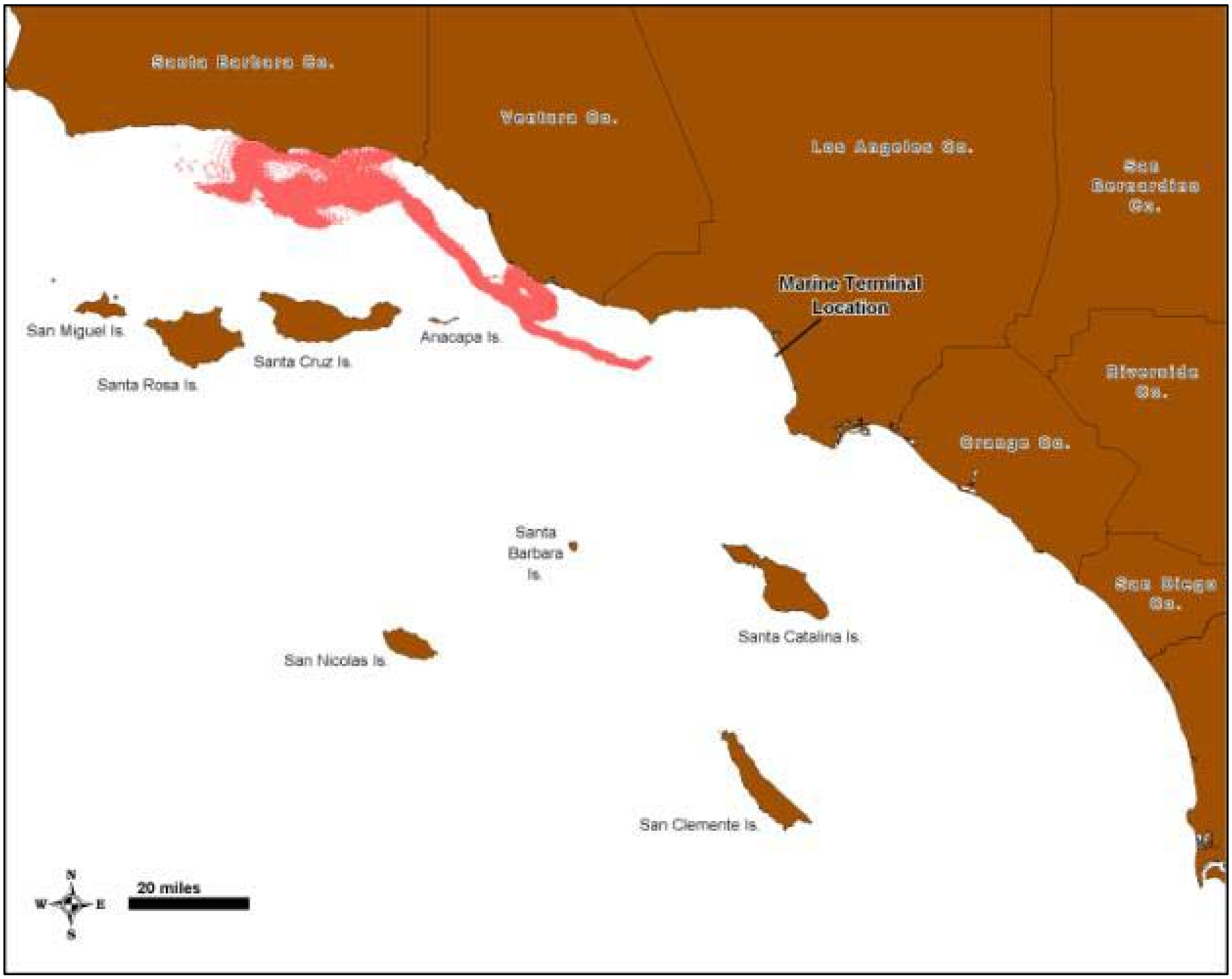
Figure 4.1-6
Time Frame of Worst-Case Tanker Spills



<u>Individual Spill Scenario Impacts</u>

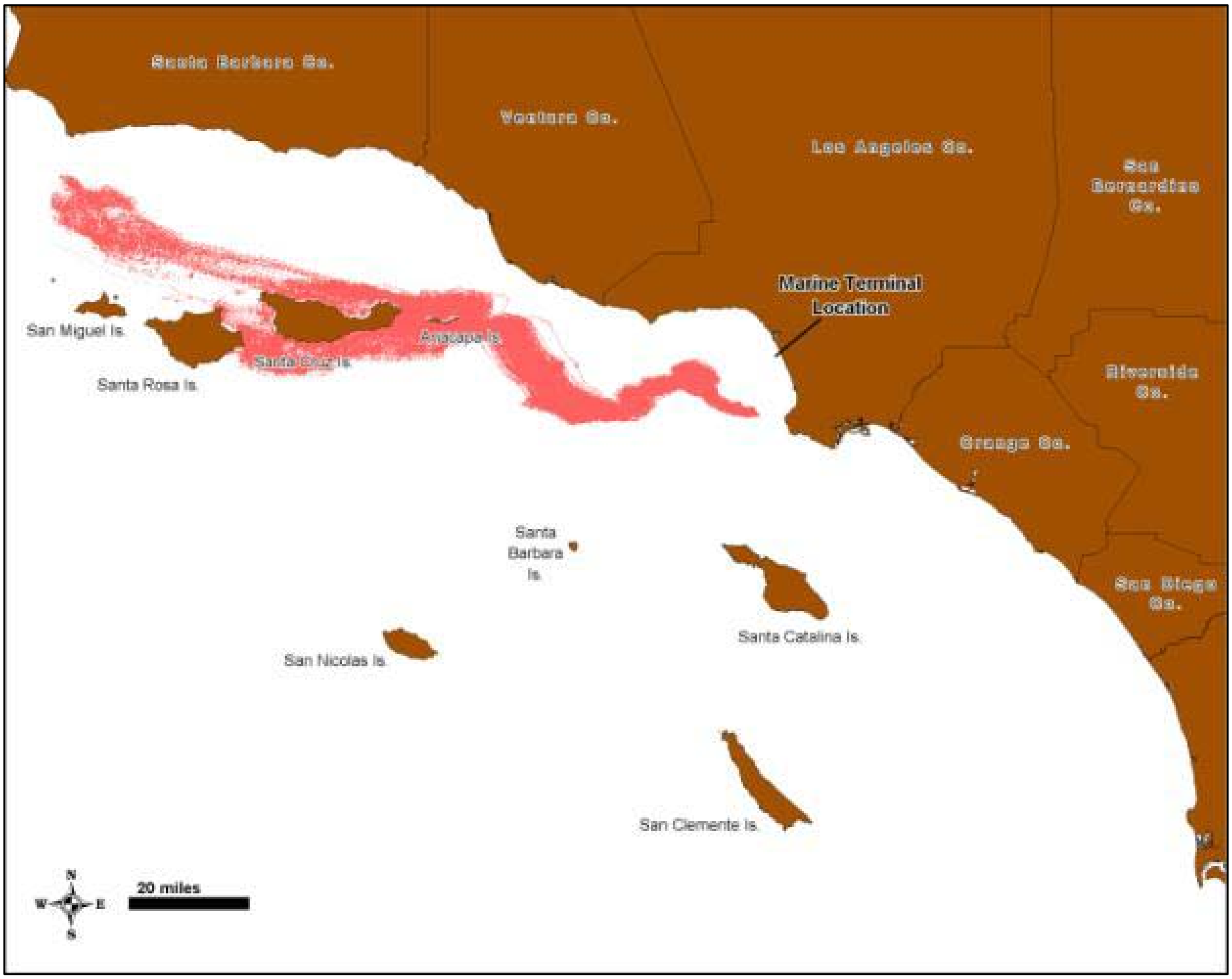
As discussed for spills at the Marine Terminal, impact indices, such as water surface exposure to floating oil, were analyzed for each of the scenarios for the tanker spills. Figures 4.1-7 and 4.1-8 show the worst-case individual spill impacts to the mainland and the Santa Barbara Channel Islands.

Figure 4.1-7
Worst-Case Spill Impacts to the Mainland from a Tanker Spill



Note that these scenarios are from a tanker spill between the Marine Terminal and the shipping lanes. Spills along the shipping lanes could also occur and impact areas all along the California Coast, depending on the location of the spill and wind conditions at the time of the spill.

Figure 4.1-8
Worst-Case Impacts to the Channel Islands from a Tanker Spill



The time frame for the impacts to the Santa Barbara Channel Islands would potentially be shorter than those associated with spills from the Marine Terminal since the spill location would potentially be closer to the Santa Barbara Channel Islands. The models estimate that a spill would take five days to reach Anacapa Island. The time frame for the impacts to mainland along Santa Monica Bay or to the water column would be short, on the order of a few days at most, if the tanker spill were to occur close to or at the Marine Terminal.

The length of shoreline that could be impacted and the percentages of oil spilled that could come ashore for the worst-case individual spills are shown in Table 4.1-12 and 4.1-13.

The lengths of shoreline oiled for the tanker spills were determined based on total shoreline oiled at a specific threshold. The shoreline oiling results are affected by wind conditions in the various cases. For instance, if a particular spill from a vessel near the Marine Terminal site occurs during a period of eastward winds, the oil would be driven directly into shore, resulting in a greater area of heavily oiled shoreline as compared to a case where the oil is driven offshore by southward directed winds.

Table 4.1-12
Worst Case Shoreline Fate for Individual Tanker Spills

Scenario Name	Shoreline Length – Mainland, miles (km)	Shoreline Length – Islands, miles (km)
Lightly Soiled*, More than 100 g/m^2		
Diesel; 2,500 bbl	1.6 (2.7)	10.3 (17.2)
Light crude; 2,500 bbl	2 (3.3)	14.4 (24.1)
Heavy crude; 2,500 bbl	5.2 (8.6)	9.1 (15.1)
Diesel; 275,000 bbl	41.4 (68.9)	90.7 (151.2)
Light crude; 275,000 bbl	36 (60)	90.2 (150.3)
Heavy crude; 275,000 bbl	30.7 (51.1)	59.2 (98.6)
Heavily Soiled, More than 1,000 g/m^2		
Diesel; 2,500 bbl	0 (0)	0 (0)
Light crude; 2,500 bbl	0 (0)	5 (8.3)
Heavy crude; 2,500 bbl	1.8 (3)	4.6 (7.7)
Diesel; 275,000 bbl	16.4 (27.3)	17.5 (29.1)
Light crude; 275,000 bbl	23.7 (39.5)	83.1 (138.4)
Heavy crude; 275,000 bbl	28.7 (47.8)	56.7 (94.5)

Notes: * Lightly soiled equates to the threshold for intertidal impacts. See Appendix C.

Table 4.1-13
Worst Case Spill Fates for Individual Tanker Spills
Percent of Spill

Scenario Name	Coming Ashore	In Sediment	In Water Column
Diesel	12.1	6.7	35.2
Light crude	32.2	19.4	42.7
Heavy crude	47.1	0.22	24.7

Notes: Since the percentages are the worst-case taken from the large number of modeling runs, they do not individually occur as part of the same spill scenario and therefore do not necessarily add up to 100 percent.

The worst-case impacts to the California mainland for tanker scenarios were those where oil was blown north and west into the Santa Barbara Channel and contacted the coast near Santa Barbara (see Figure 4.1-7). Similarly, the worst case runs to the Santa Barbara Channel Islands for tanker scenarios were those where oil was blown westward from Santa Monica Bay and then north and west onto the coasts of Anacapa, Santa Cruz, and Santa Rosa Islands (see Figure 4.1-8). The trajectories for the worst-case runs to the California mainland and islands for both diesel and heavy crude followed similar paths to those shown for light crude; however, they varied slightly based on the volume of oil released, and therefore the mass of oil on the water surface, and the weathering properties of the different oils (see Appendix C, Oil Spill Modeling).

The worst-case runs relevant to the water column for the tanker scenarios were those in which the winds were strong enough to cause high entrainment into the water column. This usually would occur before a large area of water could be swept by surface oil. Therefore, the footprints of these spill trajectories are much smaller than those for the worst cases to the California mainland and the Islands. The diesel spills were the scenarios where there was the most exposure to the water column because the viscosity of diesel is low and water column contamination is highest for diesel and less so for more viscous crude oils, and heavier fuels.

The 2,500-bbl tanker spills were run for the same conditions as all three of the worst-case runs for the 275,000-bbl tanker spills. The trajectory paths and timing for the 2,500-bbl scenarios would look the same as those for the 275,000-bbl scenarios, except the mass would be 0.9 percent of the larger spills.

Fires and Explosions

Fires and explosions at the Marine Terminal involving vessels and the Marine Terminal are possible. However, some vessels that visit the Marine Terminal employ inert gas systems (IGS), which can substantially reduce the potential for explosions. An IGS generates an inert gas that is injected into the cargo tanks to displace oxygen to a level below 10 percent that will not support ignition. Chevron maintains specific guidelines involving IGS and crude oil washing (COW) operations (Chevron 1982). Prior to the commencement of transfer operations, the Mooring Master of a ship equipped with IGS is required to provide the Marine Terminal with a signed declaration as well as the Marine Terminal IGS and COW operation checklist that states that the IGS is operational, that the cargo and slop tanks are inerted, and that the IGS will be kept in operation as necessary. Product transfer rates and temperatures are also controlled depending on the type of material being transferred. For example, products with flash points greater than 150°F (65.6°C) do not generate enough vapors to support ignition unless the product is heated to a temperature above 150°F (65.6°C). A vessel's IGS prevents products handled at this temperature from igniting.

Based on the MMS Tanker Spill Database, 22 percent of spills greater than 1,000 bbl at a pier were due to fires or explosions (MMS 1994). The International Tanker Owners Pollution Federation database of tanker spills indicates that between 1974 and 2007 fires caused approximately 1.4 percent of all tanker spills (ITOPF 2007).

Fires generate radiant heat, and an explosion could create flying debris and blast overpressure. The POLA and POLB have Risk Management Plans that specify a methodology to be utilized for calculating the "hazard footprint," or area at risk, from fires and explosions from marine terminals, tankers, and barges (POLA 1983, POLB 1981). This methodology was applied to calculate a hazard footprint for the Marine Terminal. Hazard footprints are not calculated for vessels equipped with IGS because the risk of fire or explosion is considered to be so small.

In a previous study, the radiant heat footprint capable of causing second-degree burns to exposed skin after 30 seconds of exposure (1,600 British thermal units per square foot per hour) was calculated to be 300 feet (91.4 m) around ships capable of carrying 300,000 bbl of oil (POLA 1983). By applying this estimate to the maximum capacity of Chevron tankers, 1.14 million bbl, the radiant heat hazard distance is estimated at 700 feet (213.4 m) at the Marine Terminal. An explosion involving one of the tanks of the tanker could send flying debris up to 0.3 miles (0.5 km) from the ship. Neither the radiant heat nor the flying debris hazard footprint would be expected to present a hazard to the onshore public, because the berths are approximately 1.4 to 1.5 miles (2.3 to 2.4 km) from shore. However the radiant heat, blast overpressure, or the flying debris hazard footprints may present hazards to workers and public boating in the area near the berths or cause damage to a tanker resulting in spills to marine waters.

The first line of defense for a fire on board a tanker or barge would be the onboard fire protection systems. Tankers are required to have fire fighting systems that include fire pumps, piping, hydrants, and foam systems (46 CFR Part 34). Barges are only required to have portable fire extinguishers, although some are also equipped with built-in systems. The onboard firefighting equipment is sufficient to extinguish most fires, and the tank vessel crews are trained to use the equipment. Additional fire response equipment is located at the onshore portion of the Marine Terminal. Chevron maintains its own fire and emergency response department with full-time trained personnel at the Refinery. These personnel are trained in fighting petroleum fires and fires at the onshore portion of the Terminal. Although these protective measures reduce the potential for fires and explosions, they do not eliminate the risk.

To ensure that the possibility of fire and explosion events occurring is low, the various components of routine Marine Terminal operations were analyzed from a system safety perspective in a Hazard and Operability (HAZOP) study of the Marine Terminal (Chevron 1999). The HAZOP study involved the following tasks:

- Performance of an accident risk analysis of terminal operations;
- Identification of possible accident scenarios; and
- Identification of suggested mitigation measures.

The reference used for performance of the HAZOP study was the Chevron El Segundo USCG Marine Terminal Operations Manual, from November 1993 (Chevron 1993). The HAZOP scope of work was restricted to the system between the first isolation valve on a tanker ship and the first motor-operated valve onshore. The HAZOP team consisted of personnel from Parsons Engineering Science and Chevron, with CSLC personnel present as observers. The team witnessed ship positioning and hose connection operations onboard tankers. The HAZOP team then reviewed the hose connection and disconnection procedures and reviewed the pipeline system and the ship-to-shore and shore-to-ship equipment and procedures. A detailed inspection of the onshore terminal facilities was included in this review.

The HAZOP study was based on the guide word approach. This technique was developed by the American Institute of Chemical Engineers (AIChE) to identify hazards and operability problems that may undermine the ability to maintain safe conditions at all times (AIChE 1992). During the HAZOP analysis, all information received from Chevron personnel regarding plant process, safety precautions, safety equipment, and health protection procedures was studied. Piping and instrumentation diagrams, layouts, and manuals were consulted. Hydrocarbon transfer operations were reviewed, and the effectiveness of the detection, monitoring, and control systems included in the design was also assessed.

The results of this analysis were qualitative and focused on: identification of hazards and operating problems; recommendations for changes in design or procedures to improve safety; and recommendations for follow-up studies where no conclusions were possible due to lack of information. As a result of the HAZOP analysis, deviations were found that could potentially affect safety at the Marine Terminal during routine operations. These deviations included the following:

- No "Hose Connection/Disconnection Procedure" is included in the operations manual. This information is needed to alert operators of consequences of possible errors.
- No "Emergency Shutdown Procedure" section exists to address transfer operation procedures, including the possibility of shore booster pump failure.

The Chevron Marine Terminal Manual (revised February 2004) has been amended to include procedures for hose connection and disconnection and emergency shutdowns as recommended in the HAZOP analysis.

An update to the 1999 HAZOP study was performed in March 2005 as part of the Process Safety Management of Highly Hazardous Chemicals (Chevron 2005, 8 CCR Section 5189). The study identified a number of additional measures including the following:

- Bow tube and thruster leaks are undetectable at sea and more apparent while maneuvering in confined area;
- Consider designing a more reliable Motor Operated Valve (MOV) control system (carryover from 1999 Process Hazards Analysis [PHA]);
- Consider troubleshooting Berth 3 continuous vacuum system;
- Consider troubleshooting Berth 4 continuous vacuum system; and
- Consider replacing current Pump 7 with non-reciprocating pump.

The status of some of these recommendations is unknown and, therefore, they have been added as mitigation measures.

Hazardous Materials

Contamination of soils, marine sediments, and groundwater at the Marine Terminal is discussed in the following subsections.

Onshore Soil Contamination at the Marine Terminal

A Category B Site Assessment was conducted at the onshore components of the Marine Terminal by Radian Corporation wherein samples were collected from 22 boreholes (1994). Groundwater elevations encountered during the investigation ranged from approximately sea level (0 feet) to 15 feet (4.6 m) above mean sea level (MSL).

Ground surface elevations at the sample sites ranged from approximately 11 to 30 feet (3.4 to 9.1 m) above MSL. Floating product (liquid hydrocarbons [LHC]) was encountered in eleven of the boreholes, with a thickness ranging from trace (sheen) to 1.4 feet (0.4 m). Evidence of liquid-phase hydrocarbons in soil was observed in 14 of the 22 boreholes. Hydrocarbon-stained soil was observed in 20 of the 22 boring locations.

Oil and grease concentrations detected in the soil samples ranged from not detected (< 50 milligrams per kilogram [mg/kg]) up to 40,000 mg/kg. Volatile organic compounds detected in the soil samples included benzene (0.54 mg/kg), ethylbenzene (200 mg/kg), and total xylenes (120 mg/kg). Semi-volatile organic compounds detected in the soil samples included acenaphthene (3 mg/kg), bis (2-Ethylhexyl) phthalate (1.6 mg/kg), chrysene (3.7 mg/kg), dibutyl phthalate (16 mg/kg), fluoranthene (2.4 mg/kg), 2-methylnaphthalene (29 mg/kg), naphthalene (12 mg/kg), phenanthrene (13 mg/kg), and pyrene (2.7 mg/kg). Concentrations for nine of the metals tested were above the established screening criteria (Radian 1986). They include: arsenic (7.8 mg/kg), copper (72 mg/kg), lead (180 mg/kg), manganese (890 mg/kg), mercury (2.8 mg/kg), molybdenum (12 mg/kg), selenium (0.89 mg/kg), silver (1 mg/kg), and zinc (260 mg/kg). Concentrations identified in enclosed parentheses are the highest value detected. Soil pH at the Terminal ranged from 6.3 to 9.0.

According to Chevron, the soil contamination is the result of past leaks at the Chevron Refinery (CSLC 1995). There are no plans to remediate the soil while the Refinery is in operation. In the event that the Refinery should cease operations, the contaminated soils will be addressed at that time.

Sediment in Santa Monica Bay

Sediments in the Santa Monica Bay are predominately sand (60 to 80 percent), with up to 10 percent gravel, at all water depths west and southwest of the Marine Terminal (HEDD 1990). Storm events and prevailing currents cause seasonal changes in the sediment composition. Sand that accumulates on beaches in the summer is moved offshore by winter storms to depths of approximately 10 to 20 feet (3.0 to 6.1 m) (HEDD 1990). Nearshore sediments generally move along contours in a southerly direction towards Redondo Canyon.

Physical characteristics of the sediment are a function of shoreline erosion, sediment transport, and settlement of particulate material out of the water column. Chemical characteristics result from natural factors and human inputs. Investigations conducted in 1988 analyzed sediment samples from Santa Monica Bay for selected metals, sulfides, total organic carbon, total oil and grease, and organic compounds (HEDD 1990). These concentrations were then compared to reference values from areas lacking contamination. The following reference values, generated in studies conducted by Thompson and the Southern California Association of Governments, were used for: cadmium, 170 micrograms per kilogram (µg/kg); chromium, 25,000 µg/kg; copper, 9,700 µg/kg; lead, 4,400 µg/kg; silver, 27 µg/kg; zinc, 43,800 µg/kg; and mercury, 24 µg/kg metals (Thompson et al. 1987, SCAG 1988).

The comparisons were expressed as enrichment values. Enrichment values are dimensionless values representing the magnitude of elevation for the detected concentration relative to the reference value. For example, if the concentration of lead at a reference station is 5,000 µg/kg and the concentration of lead at a sample station is 78,000 µg/kg, then the enrichment value is 15.6. Based on concentration maps, sediments in the general vicinity of the Marine Terminal exhibit the following enrichment factors: cadmium (<11), copper (<3), silver (<100), mercury (<9 and <18), lead (<3, <5, and <7), DDT and its breakdown products DDD and DDE (<2.5), and PCBs (<1.75) (HEDD 1990).

Groundwater Contamination

The LARWQCB issued Cleanup and Abatement Order No. 88-055 in May 1988 to address remediation of the LHC present in the Old Dune Sand Aquifer groundwater at the Chevron Refinery and Marine Terminal. The Chevron cleanup plan consists of extracting groundwater through extraction wells and recovering LHC. Extracted groundwater is sent to the Refinery's oil and water separator for primary treatment prior to ocean discharge. Recovered LHC are reprocessed at the Refinery while extracted groundwater is replaced via injection of potable water into the subsurface.

Groundwater monitoring results for three Refinery Observation Wells (ROW168A, ROW77, and ROW171), along the eastern perimeter of the Marine Terminal, were reviewed (Radian 1994, Hascup 1994). Groundwater monitoring conducted on November 2, 1993, and during the first quarter of 1994, did not indicate the presence of measurable LHC (Radian 1994, Hascup 1994). According to Radian, decreasing trends for phenolics and toluene were observed in the three wells at the Marine Terminal (Radian 1994). Benzene and xylene concentrations exhibited decreasing trends in at least two of the wells. Concentrations of barium were above the upper tolerance limit (UTL) in two of the wells, and arsenic concentrations were above the UTL in one of the wells (Radian 1994). The UTL is the upper end of the range based on monitoring data from these groundwater extraction wells while the lower end of the range is the lower tolerance limit. A range of expected values for comparison with future monitoring results was established, although these end points are not water quality standards.

Recent benzene concentrations in the three monitoring wells ranged from 0.33 to 0.83 micrograms per liter (µg/l). Concentrations of methyl tertiary butyl ether in the three wells ranged from 5.3 to 49 µg/l (LHC 2006). Tertiary butyl alcohol concentrations ranged from 6.3 to 13,000 µg/l.

The current projected discharge to the treatment system during the life of the Cleanup and Abatement Order is 1.15 million gallons per day (Woodward-Clyde 1993). The groundwater remediation activities are currently in progress. No final date for completing these activities has been identified.

4.1.2 Regulatory Setting

Laws and regulations that address terminal operations, including emergency response and contingency planning, have been adopted by various international, Federal, State and local agencies. The following sections summarize the responsibilities of these governmental agencies as well as the relevant laws and regulations.

International Maritime Organization

The major body governing the movement of goods at sea is the International Maritime Organization (IMO), which does so through a series of international protocols. The United Nations established the IMO in 1958 to coordinate countries of registry. These countries must approve and adopt the protocols before they become effective. An agreement of the International Convention for the Prevention of Pollution from Ships in 1973 as modified by the Protocol of 1978 (MARPOL 73/78) resulted in annexes that govern the movement of oil and specify tanker construction standards and equipment requirements. Regulation 26, Annex I of MARPOL 73/78, requires that every tanker greater than 150 gross tons carry onboard a shipboard oil pollution emergency plan that is approved by IMO. MARPOL 73/78 took effect on April 4, 1993, for new ships and entered into force on April 4, 1995, for existing ships.

The U.S. implemented MARPOL 73/78 with passage of the Act to Prevent Pollution from Ships of 1980. The IMO issued Guidelines for the Development of Shipboard Oil Pollution Emergency Plans to assist tanker owners in preparing plans that comply with the cited regulations and to assist governments in developing and enacting domestic laws that give force to and implement these regulations (IMO 1992). Plans that meet

OPA 90 and the Lempert-Kenne-Seastrand Oil Spill Prevention and Response Act (SB 2040) requirements also meet IMO requirements.

MARPOL 73/78, Annex I regulations 13G and 13 H, which came into effect on April 5, 2005, address the phase-out of single-hull oil tankers. The U.S. is not a party to this MARPOL regulation as it applies to U.S. flagged vessels, but rather adheres to the OPA 90 phase-out dates, 2010 and 2015, for single-hull tankers.

MARPOL Annex VI (Prevention of Air Pollution from Ships) came into force May 19, 2005. MARPOL Annex VI sets limits on sulfur oxide (SO_x) and nitrogen oxide (NO_x) emissions from ship exhausts and prohibits deliberate emissions of ozone depleting substances. The annex includes a global cap of 4.5 percent on the sulfur content of fuel oil and calls on the IMO to monitor the worldwide average of sulfur content of fuel. Annex IV contains provisions allowing special SO_x Emission Control Areas (SECA) with more stringent controls on sulfur emissions. In these areas, the sulfur content of fuel oil used on board ships must not exceed 1.5 percent. Alternatively ships must fit an exhaust gas cleaning system or use any other technological method to limit SO_x emissions. The Baltic Sea Area is currently the only designated SECA.

Oil Companies International Marine Forum

The Oil Companies International Marine Forum (OCIMF), an international group of vessel owners and charter operations, has developed a set of comprehensive minimum standards for offshore lightering, now in its third edition. The guidelines contain advice on lightering procedures and arrangements, as well as specifications for mooring, fenders, and cargo transfer hoses. At least two industry groups have established industry guidelines for lightering and most individual companies have developed their own internal guidelines.

In the U.S., the Industry Taskforce on Offshore Lightering, a cooperative organization that promotes industry self-policing and works in partnership with the USCG, developed a supplement to the OCIMF guidelines.

Federal

There are a number of federal laws that regulate marine terminals and vessels. These laws address, among other things, design and construction standards, operational standards, and spill prevention and cleanup. Regulations to implement these laws are contained primarily in 33 CFR (Navigation and Navigable Waters), 40 CFR (Protection of Environment), and 46 CFR (Shipping).

The Refuse Act of 1889 was one of the first federal laws that prohibited ships and wharves from discharging material from into U.S. waters. These key acts also address oil pollution and discharges:

- Oil Pollution Act of 1990;
- Federal Water Pollution Control Act (FWPCA) of 1972 and Clean Water Act (CWA) of 1977;
- Water Quality Act of 1987; and
- Act to Prevent Pollution from Ships of 1980.

Oil Pollution Act of 1990

The OPA 90, the FWPCA of 1972, and the CWA of 1977 are the primary federal laws governing discharge of oil; notification, cleanup, and emergency response actions; and the responsibilities and liability of the responsible party and the Federal government. The OPA 90 is the most recent act to address spill prevention and response.

The OPA 90 was enacted to expand prevention and preparedness activities, improve response capabilities, ensure that shippers and oil companies pay the costs of spills, and establish an expanded research and development program. The Act also established a $1-billion Oil Spill Liability Trust Fund financed by a tax on crude oil. The USCG, U.S. EPA, and the Research and Special Programs Administration within the USDOT developed regulations to implement OPA 90 for transportation-related facilities, e.g., marine terminals, vessels; non-transportation-related facilities, e.g., storage tanks, refineries; and for onshore pipelines. The EPA regulations were developed in 1994 and most recently updated in 2002.

The USCG initially issued Oil Spill Contingency Plan requirements for vessels and marine transportation-related (MTR) facilities as interim final rules to meet statutory deadlines. On April 11, 1996, the USCG issued final regulations to replace the interim final rule requiring Oil Spill Contingency Plans for certain vessels that carry oil in bulk as cargo. Vessel owners or operators who submitted response plans under the interim final rule prior to April 11, 1996, were required to revise their response plans to conform with the requirements of the final rule by the plan’s five-year resubmission date. On May 29, 1996, the USCG adopted final regulations requiring response plans for MTR facilities that could reasonably be expected to cause substantial harm to the environment by discharging oil into or on any navigable waters of the U.S. or adjoining shorelines. MTR facility owners or operators who submitted response plans under the interim final rule prior to May 29, 1996, were required to revise their response plans to conform with the requirements of the final rule by the plan's five-year resubmission date.

Federal Water Pollution Control Act and Clean Water Act

The FWPCA is aimed at restoring and maintaining the chemical, physical, and biological integrity of U.S. waters. First enacted in 1948, the FWPCA was amended numerous times was and ultimately reorganized and expanded in 1972. After 1977 amendments, the FWPCA was commonly known as the CWA. The Water Quality Act of 1987 further amended the FWPCA, and the FWPCA is still amended almost every year.

Even prior to the 1972 version, the FWPCA authorized the Public Health Service to prepare comprehensive programs for eliminating or reducing the pollution of interstate waters and tributaries and improving the sanitary condition of surface and underground waters. The EPA now maintains primary authority for implementing and enforcing the FWPCA. The FWPCA authorizes water quality programs, requires federal effluent limitations and state water quality standards, requires permits for discharging pollutants into navigable waters, provides enforcement mechanisms, and authorizes funding for wastewater treatment works construction grants and state revolving loan programs, as well as funding to states and tribes for their water quality programs. Added provisions address water quality problems in specific regions and specific waterways.

The FWPCA also states that there should be no oil or hazardous substances discharged into or upon the navigable waters of the U.S., on adjoining shorelines, or into or upon the waters of the contiguous zone, or that may affect natural resources belonging to, appertaining to, or under the exclusive management or authority of the U.S.

The FWPCA imposes liability for the costs of removing discharged oil and hazardous substances, as well as for natural resource damages. It also imposes administrative and civil penalties for unlawful discharges and failures to carry out orders issued under the FWPCA. The FWPCA also establishes a national response system and requires a National Contingency Plan to provide for efficient and coordinated action to minimize damage from oil discharges, including containment, dispersal, and removal.

The Act to Prevention Pollution from Ships, as amended by the Marine Plastic Pollution Research and Control Act of 1987, requires ships in U.S. waters, and U.S. ships wherever located, to comply with the International Convention for the Prevention of

Pollution from Ships. Annex V to the Convention generally prohibits disposing plastics and other garbage into the sea.

Several agencies share responsibilities for implementing and enforcing the federal regulations addressing terminals, vessels, and pollution control, discussed in the following sections.

USCG

The USCG is the federal agency responsible for vessel inspection; vessel navigation and traffic; coordination of federal responses to marine emergencies; enforcement of marine pollution statutes; marine safety (e.g., navigation aids); operation of the National Response Center for spill response; and the lead agency for offshore spill response. The regulations for these functions are in CFR 33 and 40. The USCG issued regulations to implement OPA 90 in 1994. As part of these responsibilities, the USCG reviewed the Operations Manual at Chevron's Marine Terminal and issued a Letter of Adequacy for the Operations Manual (Chevron 2004b).

The USCG also issued a final rule addressing double hull standards for vessels (tankers and tank barges) carrying oil in bulk operating in the navigable waters or the U.S. Exclusive Economic Zone in 1992. The original rule, amended in 2000, and based on OPA 90, requires all new tank vessels to have double hulls and establishes a timetable for phasing out single-hull, double-bottom, and double-sided tankers according to their size and age beginning January 1, 1995. Table 4.1-14 summarizes the phase-out schedule. As indicated in the table, larger non-double hull vessels must be phased out at a younger age than smaller vessels. Single-hull vessels greater than 30,000 dead weight tons (DWT) must be phased out at 28 years old, while single-hull vessels between 5,000 and 30,000 DWT must be phased out at 40 years old. Therefore, double-bottom or double-sided vessels can essentially operate five years longer than single-hull vessels.

Table 4.1-14
Maximum Age (Years) of All Non-Double Hull Vessel

Year[1]	Vessel Size (DWT)					
	5,000 - 15,000		15,000 - 30,000		>30,000	
	Bottom/Side Type					
	Single	Double	Single	Double	Single	Double
1995	40	45	40	45	28	33
1996	39	44	38	43	27	32
1997	38	43	36	41	26	31
1998	37	42	34	39	25	30
1999	36	41	32	37	24	29
2000	35	40	30	35	23	28
2001	35	40	29	34	23	28
2002	35	40	28	33	23	28
2003	35	40	27	32	23	28
2004	25	30	26	31	2	28
2010	0	0	0	0	0	0
2015	0	0	0	0	0	0

[1]Designates the maximum age of non-double hull vessels of a given type allowed to operate by the USCG in January 1 of the year specified. All vessels with both single sides and bottoms will be phased out by 2010; those with double bottoms or sides, but not both, will be phased out by 2015. All vessels after 2015 will be double-hulled.
Source: 33 CFR Appendix 6 to Part 157 2000

Private vessels transit the Project area, since the Marine Terminal is located in open ocean midway between two heavily used marinas, Marina Del Rey on the north and King Harbor to the south in Redondo Beach. To restrict private vessel traffic in the mooring area, the USCG established a "safety zone" surrounding the Marine Terminal. In addition, the vessels calling at the Marine Terminal have a support boat in the berth area with them at all times, supplied by Gulf Caribe, and have deck and bridge watches with security duties assigned at all times.

The USCG oversees lightering operations outside port areas through six general mechanisms: vessel design requirements; operational procedures; personnel qualifications; oil spill contingency planning and equipment requirements; vessel inspection; and monitoring. The USCG promulgated three separate sets of regulations regarding lightering activities. One set applies to lightering in inshore waters, which for this purpose includes waters within 12 nautical miles of the coast, including all internal waters (i.e., lakes, bays, sounds, and rivers). The second set of regulations applies to lightering in all offshore waters, except for designated lightering zones. Offshore, for this purpose, means 12 to 200 miles (19.3 to 321.9 km) off the coast. The third, and most comprehensive, set of regulations applies in designated lightering zones more than 60 miles (96.5 km) off the coast. The Coast Guard Authorization Act of 1996 requires the USCG to coordinate with the Marine Board of the National Research Council conducting studies on the risks of oil spills from lightering off the U.S. coasts.

USCG and CDFG Area Contingency Plans

The OPA 90 required contingency planning for both state and federal governments. The USCG and CDFG OSPR agreed to joint preparation of contingency plans by co-chairing the three Port Area Committees for Contingency Planning: USCG Port Areas for San Francisco, Los Angeles/Long Beach (including the Santa Barbara area), and San Diego. The ACP addresses command, operations, planning, logistics, finance, hazardous materials, firefighting, and ecologically sensitive sites.

EPA

The EPA is responsible for the National Contingency Plan and is the lead agency in response to an onshore spill. The EPA also serves as co-chairman of the Regional Response Team, which is a team of agencies established to provide assistance and guidance to the on-scene coordinator during the response to a spill.

The EPA also regulates disposal of recovered oil and is responsible for developing regulations for Spill Prevention, Control, and Countermeasures (SPCC) Plans. The SPCC Plans are required for non-transportation-related onshore and offshore facilities with potential to spill oil into U.S. waters or adjoining shorelines. The EPA's SPCC regulations were most recently significantly revised in July 2002. The EPA reviewed and approved the Refinery SPCC in July 1992; Chevron last updated the plan on December 16, 2004 (Chevron 2004a). On February 16, 1995, the EPA approved Chevron's Oil Spill Contingency and Response Plan, which was last updated in September 2003 (Chevron 2003).

Department of Commerce through the NOAA

The NOAA provides scientific support for response and contingency planning, including assessments of potential hazards, predictions of movement and dispersion of oil and hazardous substances through trajectory modeling, and information on the sensitivity of coastal environments to oil and hazardous substances. It also provides expertise on living marine sources and their habitats, including endangered species, marine mammals, and National Marine Sanctuary ecosystems. It disseminates information on actual and predicted meteorological, hydrological, and oceanographic conditions for marine, coastal, and inland waters, and tide and circulation data for coastal waters.

DOI

The DOI, through its various offices, provides expertise during spills in two areas. The U.S. Fish and Wildlife Service provides guidance on the protection of anadromous and certain other fishes and wildlife, including endangered and threatened species, migratory birds, and certain marine mammals. It also helps assess techniques for protecting waters and wetlands and preventing contaminants affecting habitat resources. The U.S. Geological Survey provides guidance regarding physical conditions of the site, including the local geology, hydrology (groundwater and surface water), and natural hazards.

Department of Defense

The Department of Defense, through the Army Corps of Engineers, is responsible for reviewing all aspects of a project and spill response activities that could affect navigation. The Army Corps of Engineers has specialized equipment and personnel for maintaining navigation channels, removing navigation obstructions, and accomplishing structural repairs.

DOT

The USDOT (or designated state agency) has jurisdiction over hazardous liquid pipelines and must follow the regulations in 49 CFR Part 195, Transportation of Hazardous Liquids by Pipeline, as authorized by the Hazardous Liquid Pipeline Safety Act of 1979 (49 CFR 2004). Other applicable federal requirements are found in 40 CFR Parts 109, 110, 112, 113, and 114, pertaining to the need for Oil SPCC Plans, and 40 CFR Parts 109 through114 promulgated in response to OPA 90, as well as the Outer Continental Shelf Lands Act. In addition, 49 CFR Part 195 addresses pipeline integrity management plans.

Overview of 49 CFR 195 Requirements

Part 195.30 incorporates many of the applicable national safety standards from:

- American Petroleum Institute;
- American Society of Mechanical Engineers;
- American National Standards Institute; and
- American Society for Testing and Materials.

Part 195.50 requires reporting accidents by telephone and in writing for:

- Spills of 50 bbl (2,100 gallons or 7.9 m^3) or more;
- Daily loss of five bpd or more (0.8 m^3/day) to the atmosphere;
- Death or serious injury of a person; and
- Damage to property of operator or others greater than $5,000.

The Part 195.100 series includes design requirements for the temperature environment, variations in pressure, internal design pressure for pipe specifications, external pressure and external loads, and new and used pipes, valves, fittings, and flanges.

The Part 195.200 series provides construction requirements for standards such as compliance, inspections, welding, siting and routing, bending, welding and welders, inspection and nondestructive testing of welds, external corrosion and cathodic protection, installing in-ditch and covering, clearances and crossings, valves, pumping, breakout tanks, and construction records.

The Part 195.300 series prescribes minimum requirements for hydrostatic testing, compliance dates, test pressures and duration, test medium, and records.

The Part 195.400 series specifies minimum requirements for operating and maintaining steel pipeline systems, including:

- Correction of unsafe conditions within a reasonable time;
- Procedural manual for operations, maintenance, and emergencies;
- Training;
- Maps;

- Maximum operating pressure;
- Communication system;
- Cathodic protection system;
- External and internal corrosion control;
- Valve maintenance;
- Pipeline repairs;
- Overpressure safety devices;
- Firefighting equipment; and
- Public education program for hazardous liquid pipeline emergencies and reporting.

Part 195.452 addresses Pipeline Integrity Management Plans in High Consequence Areas for Hazardous Liquid Operators that existed on or after May 29, 2001. Integrity Management Plans specify regulations to assess, evaluate, repair, and validate, through comprehensive analysis, the integrity of hazardous liquid pipeline segments that, in the event of a leak or failure, could affect populated areas, areas unusually sensitive to environmental damage, and commercially navigable waterways. Section h.4 of 49 CFR 195.452 specifies repair criteria for pipelines based on smart pig results. These require that immediate repairs shall be conducted for the following conditions:

- Metal loss greater than 80 percent of nominal wall regardless of dimensions;
- Predicted burst pressure less than the established maximum operating pressure;
- A dent on the top of the pipeline with indication of metal loss, cracking or a stress riser; and
- A dent on the top of the pipeline with a depth greater than six percent of the nominal pipe diameter.

An operator must schedule evaluation and remediation of the following conditions within 60 days for the following conditions:

- All of the items listed above for the immediate repair period;
- A dent on the top of the pipeline with a depth greater than three percent of the pipeline diameter (or 0.25 inches [0.65 cm] deep for a pipeline with a diameter less than 12 inches [30.5 cm]).
- A dent on the bottom of the pipeline with any indication of metal loss, cracking, or a stress riser.

An operator must schedule evaluation and remediation of the following conditions within 180 days for the following conditions:

- All of the items listed above for the 60-day and immediate repair periods;
- A dent with a depth greater than two percent of the pipeline's diameter that affects pipe curvature at a girth weld or a longitudinal seam weld (or 0.25 inches [0.65 cm] in depth for a pipeline diameter less than 12 inches [30.5 cm]);
- A dent on the top of the pipeline with a depth greater than 2 percent of the pipeline's diameter (or 0.25 inches [0.65 cm] in depth for a pipeline diameter less than 12 inches [30.5 cm]) (NPS 12);
- A dent on the bottom of the pipeline with a depth greater than six percent of the pipeline's diameter’
- An area of general corrosion with a predicted metal loss greater than 50 percent of nominal wall;
- Predicted metal loss greater than 50 percent of nominal wall that is located at a crossing of another pipeline, or is in an area with widespread circumferential corrosion, or is in an area that could affect a girth weld;
- A potential crack indication that when excavated is determined to be a crack;
- Corrosion of or along a longitudinal seam weld; and
- A gouge or groove greater than 12.5 percent of nominal wall.

Overview of 40 CFR Parts 109, 110, 112, 113, and 114

The SPCC in these regulatory programs apply to oil storage and transportation facilities and terminals, tank farms, bulk plants, oil refineries, and production facilities, as well as bulk oil consumers, such as apartment houses, office buildings, schools, hospitals, farms, and state and federal facilities.

Part 109 establishes the minimum criteria for developing oil-removal contingency plans for certain inland navigable waters by state, local, and regional agencies in consultation with the regulated community (i.e., oil facilities).

Part 110 prohibits discharging oil in violation of applicable water quality standards or that would cause a film or sheen upon or in the water. Updated in 1987, these regulations adequately reflect the intent of Congress in the CWA Sections 311(b)(3) and 311(b)(4) by specifically incorporating the provision "in such quantities as may be harmful."

Part 112 deals with oil spill prevention and preparation of SPCC Plans. These regulations establish procedures, methods, and equipment requirements to prevent the discharge of oil from onshore and offshore facilities into or upon U.S. navigable waters. These regulations only apply to non-transportation-related facilities.

Part 113 establishes financial liability limits; however, OPA 90 pre-empted these limits.

Part 114 provides civil penalties for violations of the oil spill regulations.

RCRA and Associated Hazardous and Solid Waste Amendments

Implementing the RCRA created a major federal hazardous waste regulatory program administered by the EPA. Under RCRA (40 CFR 260), the EPA regulates the generation, transportation, treatment, storage, and disposal of hazardous waste. The RCRA was amended by the Hazardous and Solid Waste Amendments, which affirmed and extended regulating hazardous wastes from generation through disposal. Under RCRA, individual states may implement their own hazardous waste programs instead of RCRA, as long as the state program is at least as stringent as the federal RCRA requirements. The EPA approved California's program to implement federal hazardous waste regulations on August 1, 1992.

State

CSLC

The CSLC Marine Facilities Division is responsible for regulating and inspecting marine terminals. Through CCR sections 2300 through 2571, the Marine Facilities Division established a comprehensive program to minimize and prevent spills from occurring at marine terminals and to minimize spill impact if one occurs. These regulations established a comprehensive inspection-monitoring plan where CSLC inspectors monitor transfer operations annually.

The CSLC marine terminal regulations are similar to, but more comprehensive than the federal regulations. The CSLC regulations establish an information exchange between the terminal and vessels, information that must be contained in the Declaration of Inspection, requirements for transfer operations, and information that must be contained in the Operations Manual. All marine terminals must submit updated Operations Manuals to CSLC for review and approval.

The CCR (section 2430 of Title 2, Division 3, Chapter 1, Article 5.1) requires each marine oil terminal operator to implement a marine oil terminal security program. At a minimum, each security program must:

- Provide for the safety and security of persons, property, and equipment on the terminal and along the dockside of vessels moored at the terminal;
- Prevent and deter carrying any weapon, incendiary, or explosive on or approximately any person inside the terminal, including within personal articles;
- Prevent and deter introducing any weapon, incendiary, or explosive in stores or carried by persons onto the terminal or to the dockside of vessels moored at the terminal; and
- Prevent or deter unauthorized access to the terminal and to the dockside of vessels moored at the terminal.

The Marine Facilities Division has also issued regulations on the following:

- Inspection and monitoring (article 5, 2300);
- Marine terminal personnel training and certification (article 5.3);
- Structural requirements for vapor control systems at marine terminals (article 5.4); and
- Marine oil terminal pipelines (article 5.5).

The requirements in these sections include:

- Inspections and structural analysis once every three years (section 2320);
- Notifying CSLC of transfer operations (section 2325);
- Exchange of Information and Declarations of Inspection by Barge operator and Terminal operator (sections 2330 and 2335);
- Specific transfer requirements, communications, terminal person-in-charge and equipment requirements (section 2370, 2375, 2380);
- At all times, offshore terminals shall have the capability of drawing and maintaining a vacuum on all submarine pipelines containing oil and, at all times during mooring and unmooring operations at offshore terminals, a vacuum shall be maintained on all submarine pipelines containing oil (section 2390);
- For onshore terminals, prior to the commencement of transfer of persistent oil, a boom shall be deployed to contain any oil that might be released. Marine terminals, which are offshore or are subject to high velocity currents and where it may be difficult or ineffective to pre-deploy a boom, are required to provide sufficient boom, trained personnel, and equipment so that at least 600 feet (182.9 m) of boom can be deployed for containment within 30 minutes (section 2395);
- Employee training requirements, approval and inspections (section 2500);
- Each component of a pipeline that is exposed to the atmosphere shall be coated with material suitable for protecting the component from atmospheric corrosion (section 2563);
- Pressure testing requirements and scheduling (section 2564);
- Leak detection systems for Class II pipelines shall be implemented including: (1) Instrumentation with the capability of detecting a transfer pipeline leak equal

to two percent of the maximum design flow rate within five minutes; or (2) Completely containing the entire circumference of the pipeline provided that a leak can be detected within fifteen minutes; or (3) For transfer operations, which do not involve hoses, conducting a pressure test of the pipeline acceptable to the Division Chief immediately before any oil transfer (section 2569); and

- Preventative maintenance program including pressure testing every three years, annual cathodic protection tests (for pipelines with cathodic protection), and annual testing of emergency shut-off valves and equipment (section 2570).

Marine Oil Terminal Engineering and Maintenance Standards

The California Building Standards Commission approved the Marine Oil Terminal Engineering and Maintenance Standards (MOTEMS) on January 19, 2005. These standards apply to all existing and new marine oil terminals in California, and they include criteria for inspection, structural analysis and design, mooring and berthing, geotechnical considerations, fire, piping, and mechanical and electrical systems. The purpose of the MOTEMS is to establish minimum engineering, inspection, and maintenance criteria for marine oil terminals to prevent oil spills and protect public health, safety, and the environment. The MOTEMS do not, in general, address operational requirements. Relevant provisions from existing codes, industry standards, recommended practices, regulations, and guidelines have been incorporated directly or through reference as part of the MOTEMS.

The Office of the State Fire Marshall regulates the safety of intrastate hazardous liquid transportation pipelines. A memorandum of understanding between the CSLC and the State Fire Marshall issued on March 16, 1994, coordinated regulatory responsibilities for marine terminals and associated pipelines (CSLC 2003). Revision 2 of this cooperative agreement defined pipeline jurisdiction for specific marine oil terminals. According to this agreement, CSLC has regulatory jurisdiction for the Chevron El Segundo Marine Terminal and the six lines that service the offshore Berths 3B, 3C, and 4. More specifically, the agreement identifies the 26-inch (66.1-centimeter [cm]) and 14-inch (35.6-cm) lines, the 16-inch (40.1-cm) and 12-inch (30.5-cm) lines, and the 36-inch (91.4-cm) and 16-inch (40.1-cm) lines that service each berth, respectively.

OSPR

The OSPR was created within the CDFG to adopt and implement regulations and guidelines for spill prevention, response planning, and response capability. A memorandum of understanding between the CDFG and CSLC, issued on April 8, 1992, coordinates oil spill prevention and response. Final regulations regarding oil spill contingency plans for vessels and marine facilities were issued in November 1993 and last amended in October 2002 (Title 14, CCR, sections 815.01-820.01). Similar oil spill contingency plan requirements for non-tank vessels were issued in 2002 and last amended in March 2005 (14 CCR 825.01-827.02). These regulations, similar to but more comprehensive than their federal counterparts, require marine facilities and vessels demonstrate they have the necessary response capability on hand or under contract to respond to specified spill sizes including a worst case spill. The regulations also require conducting a risk and hazard analysis on each facility in accordance with hazard evaluation methods and guidelines established by the AIChE or an equivalent method (AIChE 1985, 1992). Financial responsibility requirements (Certificate of Financial Responsibility) are detailed in 14 CCR 791-797, which became effective in June 2003. California's requirement for financial responsibility is in excess of the federal requirements.

Initially, Oil Spill Contingency Plans were to be submitted to OSPR by April 1, 1994, for review and approval (14 CCR 816.01, 816.03). In accordance with these regulations, the Marine Terminal Oil Spill Contingency Plan was originally submitted to OSPR in April 1994. The OSPR granted conditional approval of the plan on October 7, 1994. The plan was revised and resubmitted in January 1995. The regulations require resubmitting the plan for review on April 1, 1996, on April 1, 1998, and once every five years thereafter. If the plan has not changed, a letter to the OSPR stating that the plan is complete and up-to-date may be submitted (14 CCR 816.05). In January 2003, Chevron issued an Oil Spill Contingency Plan to meet the requirements of OSPR, the USCG, and the EPA. The Response Manual includes three volumes: two Principal Volumes and one Response Manual. This Plan serves as Chevron’s most recent update of the Oil Spill Contingency Plan.

A risk and hazard analysis of the Marine Terminal operations was completed in 1994 for the 1996 EIR using an established AIChE method, the HAZOP study (CSLC 1995). More recent studies, performed in December 2000 and March 2005, used another established AIChE method, the what-if/checklist study (Chevron 2000, 2005).

The Lempert-Keene-Seastrand Oil Spill Prevention and Response Act also requires the OSPR to develop a State Oil Spill Contingency Plan. In addition, each major harbor is directed to form a Harbor Safety Committee and develop a Harbor Safety Plan addressing navigational safety, including tug escort for tankers. The Los Angeles-Long Beach Harbor Safety Committee developed and maintains a Harbor Safety Plan (last revised June 2005) that includes the operations of the offshore marine terminals at Huntington Beach and El Segundo. The Huntington Beach Marine Terminal is currently in the process of abandonment. The Harbor Safety Plan provides an overview of applicable regulations related to oil spill prevention, tug escorting of tank vessels, the responsibilities of the Vessel Transportation Service in managing ship traffic in the areas covered by the plan, and includes the executive summary section from the operations manuals of local marine terminals, including the El Segundo Marine Terminal.

California Coastal Commission

The California Coastal Commission regulates activities, including uses of the marine environment, within the coastal zone, generally within 0.6 miles (0.9 km) off the coastline, for consistency with the state coastal plan. PRC sections 30230-30236 require protection against spills from activities associated with oil and petroleum product development or transportation. This includes provisions for containment and cleanup facilities during accidental spills.

Lempert-Keene-Seastrand Oil Spill Prevention and Response Act

This Act (Government Code sections 8670.1 et seq.) requires preparation of a state oil spill contingency plan to protect marine waters. It also empowers a deputy director of the CDFG to take steps to prevent, remove, abate, respond, contain, and clean up oil spills. The Governor’s Office of Emergency Services must be notified of any oil spill in the marine environment regardless of size; that office then notifies the response agencies. Oil Spill Contingency Plans must be prepared and implemented. The Act created the Oil Spill Prevention and Administration Fund and the Oil Spill Response Trust Fund. Pipeline operators pay fees for pipelines transporting oil into the state across, under, or through marine waters into the prevention and administration fund. This Act also directs authority to the CSLC for oil spill prevention from and inspection of marine facilities (PRC sections 8750 et seq).

Area Contingency Plans

There are seven Area Committees along coastal California, and each Area Committee is responsible for oil spill response and preparedness planning within a specific geographic area. The Los Angeles/Long Beach North Area Committee includes San Luis Obispo, Santa Barbara, and Ventura counties. The Area Committees are each chaired by a USCG representative and include oil spill response representatives from federal, state, and local government agencies. The OSPR is the lead non-federal agency.

The Los Angeles/Long Beach North Area Committee developed a site-specific Oil Spill Contingency Plan called the Area Contingency Plan. The plan provides clear directives on oil spill response, including the organization of incident command, planning and response roles and responsibilities, response strategies, and logistics. In addition, site-specific response plans are described for various coastal segments where there are species and other resources of concern. The plan provides site-specific information on resources of concern, local contacts, access to sites, and containment strategies. Each of the seven Area Contingency Plans is updated annually, so the plans are current and accurate.

Oil Spill Contingency Plans Title 14 of the CCR (section 817.02) specifies the requirements for Oil Spill Contingency Plans, including prevention measures, containment booming and on water recovery, worst case spill volumes, response capability standards, onshore resources, response and notification procedures.

Local

Other state, regional, and local agencies have regulatory control over construction and operation activities at the Marine Terminal, but they are not directly charged with control of oil spills or system safety. For instance, the LARWQCB adopted the Basin Plan for Santa Monica Bay to protect its present and future beneficial uses. Although the regional board regulates prevention and abatement of water pollution, it does not regulate the discharge of oil or petroleum products by marine facilities. The role of the LARWQCB and other agencies affecting aspects of the Project, other than system safety, are discussed in subsequent sections.

In May 1988 the LARWQCB issued Cleanup and Abatement Order No. 88-055 to address remediation of the LHC in the Old Dune Sand Aquifer groundwater at the Refinery and Marine Terminal.

4.1.3 Significance Criteria

A safety impact is considered significant if the following conditions would occur as a result of the proposed Project:

- There is a potential for fires, explosions, spills of flammable or toxic materials, or other accidents from the Marine Terminal that could cause injury or death to members of the public;
- The existing facility does not conform to its oil spill contingency plans or other effective plans, or if current or future operations are inconsistent with federal, state, or local regulations. However, conformance with regulations does not necessarily mean that there are not significant impacts; or
- Existing and proposed emergency response capabilities are not adequate to effectively mitigate spills and other accident conditions.

The potential discharge of hazardous materials into the environment, such as crude oil spills, is quantified in this section; however, associated impacts to the environment are discussed in Sections 4.2, Water and Sediment Quality, and 4.3, Biological Resources.

4.1.4 Impact Analysis and Mitigation Measures

Methodology

This section reviews the potential safety consequences (e.g., exposure to toxic and hazardous substances, fire, explosions or spills) of the potential future operations of the Marine Terminal. These consequences include risks due to vessel traffic, crude and product handling, and emergency response capabilities. This analysis also includes an assessment of the cumulative risks from multiple marine terminals in the greater Los Angeles/Long Beach area.

Where significant impacts are identified, mitigation is suggested to reduce event frequency or consequences, as well as to improve response planning and spill control.

In the event of an accident or spill involving vessels calling at the Marine Terminal, sensitive areas or resources could potentially be harmed. Such vulnerable resources include biological resources; commercial vessel traffic in the Santa Monica Bay; and other commercial, recreational, cultural, and economically important resources. Section 4.3, Biological Resources, addresses the risks to biological resources. Section 4.7, Land Use, Planning, and Recreation, discusses sport fishing and recreational vessel traffic in the vicinity of the Marine Terminal.

Future Operations

Although several factors, including fluctuating crude oil markets, could affect the number of vessel calls at the Marine Terminal, as a reasonable worst case it is estimated that throughput at the Marine Terminal would increase from current levels by one percent annually over the 30-year lease.

The proposed Project could result in increased vessel calls to the Marine Terminal in the future. This could potentially result in spill scenarios that exceed the capabilities of the current response organizations in the area. However, current response organizations are extensive, relying not only on the capabilities of Chevron but on the Marine Spill Response Corporation as well. The capabilities of spill response respond in the area are well developed due to the large POLA and POLB, which both also have substantial response capabilities and handle substantially more vessel traffic than the Marine Terminal. These capabilities exceed USCG and federal requirements for boom deployment timing and lengths and would be able to respond to a spill at the Marine Terminal even with an increase in vessel traffic. This impact would therefore be less than significant.

Future Marine Terminal Operations Spill Frequency Estimates

Based on spill rates, the frequency of spills during future operations at the Marine Terminal can be estimated. Table 4.1-15 shows spill frequencies and time-between-spills for the current and future Marine Terminal operations based on worst case vessel traffic in the year 2040. The frequency of spills (using USCG and the Marine Terminal historical calculated spill rates) is estimated to increase in the future due to the increased vessel traffic. Spill frequencies associated with offshore pipelines and hoses would remain the same as the current operations (see Table 4.1-7).

Table 4.1-15
Marine Terminal Future Operations Spill Frequencies

	Annual Spill Rate, spills per 1,000 vessel calls	Baseline		Project	
		Annual Frequency, spills per year	Time Between Spills	Annual Frequency, spills per year	Time Between Spills
USCG Spill Rates					
Any Size	9.1	3.2	3.8 months	4.4	2.7 months
Less than 1,000 gallons (24 bbl)	8.44	2.9	4.1 months	4.1	2.9 months
More than 1,000 gallons (24 bbl)	0.69	0.24	4.2 years	0.34	3 years
More than 50,000 gallons (1,190 bbl)	0.14	0.047	21.2 years	0.066	15.1 years
Marine Terminal Historical Spill Rates					
Spill, Any Size	8.50	2.9	4.1 months	4.1	2.9 months
Less than 1,000 gallons (24 bbl)	8.00	2.8	4.3 months	3.9	3.1 months
More than 1,000 gallons (24 bbl)	0.41	0.14	7 years	0.20	5 years
More than 50,000 gallons (1,190 bbl)	0.14	0.05	20.6 years	0.07	14.7 years
Lightering					
Spill, Any Size	0.3	0.03	35 years	0.04	25 years
More than 1,000 gallons (24 bbl)	0.023	0.002	468 years	0.003	333 years
More than 50,000 gallons (1,190 bbl)	0.0045	0.0004	2,377 years	0.0006	1,693 years

Notes: Lightering for the proposed Project assumes future (2040) traffic of 63 VLCC vessels per year generating 132 lightering vessels that visit the Marine Terminal (as per year 2006 Marine terminal visit ratios).

Impact SSR-1: Potential for Fires and Explosions

There would be a potential in the future for fires, explosions, releases of flammable or toxic materials, and other accidents at the Marine Terminal that could affect workers and public boating in the area near the berths as well as increase the frequency of spills due to explosion and fire (Significant, Class I).

Impact Discussion

The potential for fires, explosions, releases of flammable or toxic materials, or other accidents that could cause injuries, fatalities, or spills would be primarily associated with the flammable vapors and other flammable materials transported as cargo by tankers visiting the Marine Terminal. Only an estimated 50 percent of tankers utilize gas blanketing systems, which substantially reduce the risk of fire and explosions by eliminating the availability of flammable vapors within the concentrations that could allow ignition. Vessels lacking this technology primarily present this risk. A potential increase in vessel traffic at the Marine Terminal would further increase the risks of fires and explosions. This would be considered a significant impact.

Mitigation Measures

The potential for fires and explosions at the Marine Terminal can be mitigated by instituting measures to reduce the probability of an event and to reduce the impacts if they do occur.

SSR-1a. Inert Gas Systems and Fire Response. The Applicant shall extend the use of inert gas to all vessels (tankers and barges) to reduce the possibility of fires and explosions. Monitoring shall ensure that oxygen is below 8 percent by volume. Response planning documents shall address response equipment and fire boats that would respond to a fire at the offshore location. These documents shall be completed within one year of lease renewal and reports submitted to CSLC annually thereafter.

SSR-1b. Lease Modifications. The lease for the facility shall contain a clause allowing the California State Lands Commission to add or modify mitigation measures in the event that cost-effective technologies become available that would significantly improve protection from fires or explosions if they could be readily implemented during the lease term, as defined by “best achievable technology” (PRC section 8750(d)). Modifications should be made if a fire or explosion occurs during the lease term to take advantage of lessons learned. Annual reports shall be submitted to CSLC identifying any lease modifications.

Rationale for Mitigation

Applying an inert gas system to all vessels would substantially reduce the frequency of a fire or explosion that could lead to personnel or public injuries, fatalities, or a spill. Although the risks of fire and explosions would not be eliminated, inert gas systems would reduce the frequency of these types of events by a substantial margin. Note that the POLA implemented requirements against the venting of all hydrocarbons because of previous incidents that involved explosions and fires from cargo and fuel vapors. The IMO requires an inert gas system on all new tankers and most existing tankers 20,000 DWT and heavier (approximately 150,000 bbl) (IMO 2009). Federal requirements (46 CFR 32.53) mandate inert gas systems on certain crude and product tankers above a given size and age. Even with these requirements, a number of vessels (tankers and barges) that visit the Marine Terminal do not use inert gas systems.

It is important that the CSLC have the ability to impose additional requirements that could make the transfer of cargo between the facility and the vessel safer during the period of the lease. Improvements in technology and equipment are likely to occur in the next 30 years and the CSLC shall be able to require improved equipment, as it becomes available, to lessen the threat of fires, explosions, and leaks from these operations.

Residual Impacts

Implementing the inert gas blanketing mitigation measures would substantially reduce the frequency of fires and explosions to less than the frequency associated with current operations. However, there would still remain the potential for risk of impacts to public safety from a fire or explosion and impacts would be significant (Class I).

Impact SSR-2: Potential for Spills

The potential for spills at the Marine Terminal or while vessels are in transit exists with the continued operations at the Marine Terminal (Significant, Class I).

Impact Discussion

The worst-case vessel traffic analysis presented in Section 2.0, Project Description, indicates a potential increase in vessel calls to the Marine Terminal by the year 2040. Spill risks are based on both the number of vessel calls and the amount of material handled, both of which potentially could increase in the future. Although many of the spills at the Marine Terminal are small, continued vessel traffic would continue to present the potential for spills to the ocean. This would be a significant impact.

Mitigation Measures

Implementing mitigation measures could reduce the frequency of spills or the resulting impact of spills by decreasing detection time and increasing response capabilities.

SSR-2a. Pipeline Vacuum System. The Applicant shall ensure that the pipeline vacuum system is operational and able to function at all times when the Marine Terminal is not loading. This shall be conducted within one year of lease renewal and reports submitted to CSLC annually thereafter.

SSR-2b. Pressure Point Analysis System. The Applicant shall re-assess the pressure point analysis system to ensure that it is utilizing the most recent technologies, including pressure sensor accuracy and maintenance and testing, sensor location, and pressure point analysis software, and is designed to detect pressure anomalies during loading operations. This shall be conducted within one year of lease renewal and reports submitted to CSLC annually thereafter.

SSR-2c. Testing of Spill Mitigation Equipment. The Applicant shall conduct periodic (at least annual) testing of the vacuum and pressure point analysis by utilizing by-pass valves, or other equivalent methods, to verify the function of these systems and to make adjustments as needed. This shall be conducted within one year of lease renewal and reports submitted to CSLC annually thereafter.

SSR-2d. Pipeline Leak Detection. Within one year of lease renewal, the Applicant shall ensure that both the shipping end and the receiving end of the loading pipelines are equipped with flow meters that utilize a means of conducting automatic and continuous flow balancing to an accuracy of at least two percent of maximum design flow rate within five minutes. Any deviations shall activate an alarm system at both the shipping and receiving locations. The system shall be tested at least annually by utilizing by-pass valves, or other equivalent methods, to assess the capability of the leak detection systems. Annual reports shall be submitted to CSLC.

SSR-2e. Double Hulled Vessels. During the term of the 30-year lease, all vessels that call at the Marine Terminal shall be double hulled.

SSR-2f. Pipeline Inspections. In addition to periodic inspections and surveys, within one year of lease renewal, the Applicant shall implement smart-pig inspections, cathodic inspections of the entire pipelines, bathymetric surveys and visual remote-operated-vehicle inspections of all Marine Terminal pipelines. This would require modifying some existing pipelines to allow smart-pigs to pass through all pipelines. The entire pipeline route should be visually inspected, and bathymetric surveys conducted, at least every three years or after major winter storms. Visual surveys shall inspect a minimum of unsupported spans, anchors and mooring lines and other anomalies. The cathodic protection testing should be conducted per NACE RP0169 and API570. Close interval cathodic protection testing should be conducted every three to five years to ensure that the cathodic protection system is operating correctly throughout the entire length of the pipelines. Written results of each inspection in the form of a report shall be submitted to the CSLC annually and pipelines repaired as necessary.

SSR-2g. Bow Tube and Thruster Leaks. During the term of the 30-year lease, the Applicant shall implement techniques to detect bow tube and thruster leaks for all vessels.

SSR-2h. Motor Operated Valve System. During the term of the 30-year lease, the Applicant shall ensure that the motor operated valve control system is reliable through testing and maintenance procedures, as indicated in past process hazards reports.

SSR-2i. Automatic Identification System Shipboard Equipment. During the term of the 30-year lease, all vessels calling at the Marine Terminal shall be equipped with shipboard automatic identification system equipment.

SSR-2j. Berm and Drainage at Onshore Marine Terminal. The Applicant shall install drain protection in the form of sealable coverings, valves, or another method to prevent flow of spilled oil through the drains at the onshore areas of the Marine Terminal. The drain protection would prevent a spill of material at the loading pumps or other Marine Terminal equipment from entering the drains and affecting the ocean. All areas of the onshore Marine Terminal shall be protected by berms that can contain a worst-case discharge from the pumps or pipelines, including potential drain-down from Refinery tankage. Onshore pipelines shall be protected from vehicle impacts. These protections shall occur within one year of lease renewal and reports submitted to CSLC annually thereafter.

SSR-2k. Pipeline Maintenance. Within one year of lease renewal, the Applicant shall ensure that the recommendations from all previous hazard and operability studies and the cathodic protection system reports are implemented, specifically the use of dielectric fittings, periodic offshore cathodic protection surveys and potentials, replacement of deep well anodes as necessary, monthly readings of rectifier current and voltage, inspection of the pipeline casings related to cathodic potential and corrosion, and periodic onshore and offshore inspection of pipeline systems by corrosion engineers. HAZOP studies shall be updated as required by the EPA or OSHA and reports submitted to CSLC annually.

Rationale for Mitigation

The vacuum leak detection system is used when the Marine Terminal pipelines are not loading or unloading materials. The system operates by applying a slight vacuum on the pipelines when they are not in use. If a leak develops in the pipeline while the vacuum is applied, the system would not be able to maintain a vacuum and an alarm would sound. According to the 2005 PHA, the vacuum leak detection systems required some troubleshooting. Ensuring that the system is continuously operational would ensure quick detection of leaks and a response to minimize the size of a leak and the extent of potential damage.

The pressure point analysis (PPA) system operates by monitoring pressures at different points in the pipeline systems. The current PPA system was installed several years ago. More refined techniques or installing additional pressure sensors, or different types of pressure sensors, and flow information might increase system response and improve effectiveness. The system should be thoroughly evaluated to assess the current abilities of the PPA system and whether any upgrades are necessary. Ensuring that the system is as efficient as possible would ensure quick detection of leaks and a response to minimize the size of a leak and the extent of potential damage.

Leak detection systems should be periodically tested to ensure they function as necessary. This should involve testing actual components with a leak simulation by opening bypass systems to reduce the flow or pressure at various points in the system, for example. Guaranteeing leak detection systems are operating would ensure quick detection of leaks and a response to minimize the size of a leak and the extent of potential damage.

Numerous onshore and offshore pipeline systems utilize supervisory control and data acquisition flow balancing to ensure that small leaks are detectable. By continuously monitoring flows into and out of a system and comparing total flows, this balancing system ensures that no loss occurs. The Marine Terminal currently conducts this type of comparison; however, the Terminal only periodically uses manual dipstick-style tank measuring devices during the transfer process. Continuously ensuring all materials leaving a vessel are actually received at the onshore tank farm would guarantee quick detection of leaks and a response to minimize the size of a leak and the extent of potential damage. In addition, when vessel loading times extend into nighttime or the area is foggy with reduced visibility, a leak detection system that does not rely on visual inspection could substantially reduce the response time to a leak.

Current regulations require replacement or conversion to double-hulled configuration of large tankers by 2010 and smaller tanker barges barge by 2015. Data from the USDOT indicate that more than 80 percent of crude and product tankers that call at U.S. ports were double hulled in 2007. Chevron indicates that more than 90 percent of vessels that call at the Marine Terminal are double hulled. Double-hulled vessels have a lower frequency of spills because of the added protection of the double hull provides in a grounding, collision, allision, or bottom puncture. Data from the Federal Emergency Management Agency indicate that larger spills occur five times less frequently for double-hulled vessels than for single-hulled vessels (FEMA 1989). Studies conducted to assess the effectiveness of OPA 90 indicate that “in the event of an accident involving a collision or grounding, an effectively designed double-hull tanker will significantly reduce the expected outflow of oil compared to that from a single-hull vessel” (including barges) (Marine Board 1998a). As a note, the study did not find this to be true of double-hulled vessels with single-tank-across cargo tank configurations.

The USCG Programmatic Regulatory Assessment evaluated the effectiveness of double hull requirements (USCG 2001). Overall, the assessment found that double-hull requirements will reduce the number of spills for tankers and barges by 13 percent and 16 percent and the volume of oil spilled by 21 percent and 22 percent in the future, respectively.

Requiring all tankers, including larger vessels and smaller barges, to convert to double hulls before required by regulations would reduce the risk of an oil spill.

Smart-pig technology involves passing a device through a pipeline. The device, the smart pig, is equipped with sensors that detect corrosion, dents, cracks, and other potential defects in a pipeline. Smart pigs enable early detection of situations that could lead to a pipeline spill. Smart pigs currently inspect some Marine Terminal pipelines. The Berth 3B main pipeline was most recently inspected in September 2005. Smart pigs cannot inspect the 14-inch (35.6-cm) pipeline to Berth 4 because bends in the pipeline prevent the pig's passage; the pipeline would need to be modified to be inspected by smart pigs. Regularly smart-pigging all the pipelines would reduce the frequency of spills from pipeline defects.

The 2005 PHA determined that there currently is not a method to detect leaks from vessel bow tubes and thrusters. Implementing a method, through booming or other detection technique, would reduce the frequency of spills from bow tubes and thrusters.

Vessels carrying Alaska crude oil from Alaska are equipped with required AIS. This equipment automatically relays the vessels position and traveling information to the VTIS. This enables the VTIS to use AIS instead of radar, which can be less accurate in some conditions, including inclement weather. Requiring all vessels that call at the Marine Terminal to carry AIS equipment would reduce the frequency of vessel collisions, allusions, and grounding by ensuring the VTIS has accurate information on vessel positions at all times.

A spill at the onshore area of the Marine Terminal could drain to the ocean through existing area drains or directly over the ground surface to the beach area. Ensuring that all drains are protected in the event of a spill and that any spill from pipelines or equipment would be contained within berms would decrease the frequency of uncontained spills at the onshore Marine Terminal location.

The 2008 cathodic protection surveys on the Marine Terminal recommendations are listed in the mitigation measure (Farwest 2008). However, the offshore pipelines have not been assessed for cathodic protection. Implementing the recommendations and surveying the offshore pipelines would reduce the frequency of pipeline spills and enhance the preventative maintenance of the pipeline and terminal systems.

Residual Impacts

Although the measures discussed would reduce the severity and the frequency of spills from the Marine Terminal future operations, the possibility of a spill would remain. Therefore impacts would be significant (Class I).

Impact SSR-3: Disturbance of Potentially Contaminated Seafloor Sediments

Suspension of contaminated sediments due to maintenance or replacement of pipelines and other facilities could occur as a result of the proposed Project (Potentially Significant but Mitigable, Class II).

The proposed Project could require pipeline maintenance, or, for replacement and smartpigging of the Berth 4 pipelines, would require maintenance in the near-term, which in turn could disrupt sea floor sediment in Santa Monica Bay. Sediment with concentrations of metal or organics exceeding regulatory values for hazardous waste (established in CCR Title 22) may be disturbed and suspended during rearrangement of the sea floor pipelines or replacement of these pipelines, and then redeposited at other locations. If these sediments contain toxic levels of contamination, suspending and redepositing these contaminants could result in significant adverse impacts.

Mitigation Measure

SSR-3. Sampling Program for Sediments Within the Proposed Project. 60 days prior to the start of any construction (ongoing during construction, as applicable) and prior to conducting any offshore activities that would disturb sediments, the nature of potential contamination within these sediments shall be defined. Samples should be collected and analyzed, and results summarized in a report to the California State Lands Commission and other interested parties. This report should include, at a minimum, recommendations to minimize disruption of any identified contaminated sediments, including removal if necessary. Sediments found to be contaminated shall be appropriately treated prior to conducting any offshore activities.

Rationale for Mitigation

By incorporating site-specific sediment analysis from the areas that could be impacted by pipeline maintenance or replacement over the life of the Project, impacts from future activity can be reduced.

Residual Impacts

By identifying areas that may potentially contain contaminated sediments and determining the levels of contamination within those sediments, avoidance strategies or contamination removal will avoid residual impacts from the proposed Project. By following these recommendations, impacts can be reduced to a level of insignificance (Class II).

Table 4.1-16
Summary of System Safety and Reliability Impacts and Mitigation Measures
Proposed Project

Impact	Mitigation Measures
SSR-1: Potential for Fires and Explosions	**SSR-1a.** Inert Gas Systems and Fire Response **SSR-1b.** Lease Modifications
SSR-2: Potential for Spills	**SSR-2a.** Vacuum Leak Detection **SSR-2b.** Pressure Point Analysis System **SSR-2c.** Testing Leak Detection Systems **SSR-2d.** Pipeline Leak Detection **SSR-2e.** Double Hulled Vessels **SSR-2f.** Smart-Pig Inspections **SSR-2g.** Bow Tub and Thruster Leaks **SSR-2h.** Motor Operated Valve System **SSR-2i.** Automatic Identification System Shipboard Equipment **SSR-2j.** Berm and Drainage at Onshore Marine Terminal **SSR-2k.** Pipeline Maintenance.
SSR-3: Disturbance of Potentially Contaminated Seafloor Sediments	**SSR-3.** Sampling Program for Sediments Within the Proposed Project

4.1.5 Impacts of Alternatives

Alternatives include the No Project Alternative, moving one of the berths farther offshore with a conventional mooring or a single point mooring, or requiring light crude offloaded at the POLA. The following sections discuss the impact of each of these alternatives.

No Project Alternative

Under the No Project Alternative the Marine Terminal lease would not be renewed; the Marine Terminal would cease operations and no crude oils or products would be allowed through the Marine Terminal. The Marine Terminal would no longer be operational and would eventually be decommissioned.

This alternative would eliminate the potential impact of possible oil spills, fires, and explosions at the Marine Terminal and surrounding area since the Marine Terminal would no longer be operational. However, Refinery demand for crude oil and end-user demand for refined product would remain and probably cause an increase in importation of crude oil and refined products through the POLA or POLB and to the Chevron El Segundo Refinery via pipeline, truck, and rail transport.

Refined products are generally more volatile and have higher flammability than crude oil, although both can produce fires and cause impacts to nearby receptors. Therefore, this alternative may increase the potential for fires and explosions during refined product or crude oil transfer operations at the POLA/POLB, along pipeline rights-of-way, and between the ports and area refineries (including the Chevron Refinery). Even though most Refinery products are currently transported by pipeline, pipeline use under the No Project Alternative would increase, particularly related to crude oil, and would be in closer proximity to populated areas than current offshore pipeline operations, so this would be an increased risk and would be a significant impact. Impact **SSR-1** would still be relevant and a more severe threat to public safety and populated areas, rather than a threat to the Marine Terminal or to spill impacts. Mitigation measures related to vessel gas blanketing would not apply since the POLA/POLB already require gas blanketing for all vessels.

Eliminating vessel traffic at the Marine Terminal would eliminate the spill risk at the Marine Terminal. However, spill risk would increase at the POLA/POLB associated with increased vessel traffic and loading and unloading operations, as well as along pipeline rights-of-way and along truck/railroad corridors that may transport additional crude oil. However, the POLA/POLB are established facilities with existing emergency response capabilities. Although spills within the POLA/POLB would still be considered significant impacts, spills would be contained within the ports and boomed areas. All vessels are required to be completely boomed when loading and unloading in the POLA/POLB. Vessels would still be subject to spills while outside of the ports. However, using enclosed ports would reduce the spill risks over the current, open-water Marine

Terminal. Impact **SSR-2** would remain significant, but would be less severe than the proposed Project. The POLA/POLB already require many of the mitigation measures specified under **SSR-2**. **MM SSR-2a** through **SSR-d**, **SSR-2f** through **SSR-h**, and **SSR-2j** and **SSR-2k** would not apply. **MM SSR-2e** and **SSR-2i** would still apply.

Spill risk associated with truck and rail transport or pipeline transport would increase either in frequency or volume from trucks, railroads, and pipelines, under the No Project Alternative since the trucks, railroads, and pipelines would carry more crude oil more often. However, spill volumes would be substantially less than from a vessel at the Marine Terminal and spills would not impact the marine environment as readily as spills at the Marine Terminal. Spill risks would therefore be less under the No Project Alternative than under the proposed Project or current operations.

However, removing offshore pipelines associated with abandoning the Marine Terminal could disrupt sediment in Santa Monica Bay which might cause suspension and redeposition of contaminants. This impact would be the same as Impact **SSR-3** for the proposed Project and **MM SSR-3** would apply.

CBM Relocation in State Waters for Crude Only

This alternative would involve extending the crude oil Berth 4 to a point offshore in state water that is deep enough for VLCC tankers to offload directly at the Marine Terminal. The mooring type would be the same as the current berths. This would allow VLCC to moor at the conventional buoy mooring (CBM) and offload the crude without lightering operations (although lightering operations would still continue for other terminals). This location, approximately two miles (3.2 km) offshore, is the maximum practical distance to relocate the CBM system because of water depth, impact on operations, and several other factors. Panamex-size tankers would load refined products and offload crude at the existing Berth 3 CBM, which would remain in the same location under this alternative. The maximum water depth for safe operation of a CBM is 90 feet (27.4 m); in deeper water, delays mooring the tankers would reduce terminal capacity. To reach 90 feet (27.4 m) of water, the Berth 4 buoys would be relocated approximately 0.6 miles (one km) farther offshore than the existing Berth 4 (Berth 4 is 1.5 miles [2.4 km] offshore).

Spill modeling indicates that moving the location of the Marine Terminal farther from shore would reduce impacts to the mainland shoreline, but it would increase impacts to the Santa Barbara Channel Islands. Impacts to the mainland shoreline could also extend farther south around Point Vicente towards the POLA/POLB. Table 4.1-17 shows the potential lengths of shoreline impacted by a spill for the worst-case conditions for the alternative of a berth farther offshore. Note that the release size is larger for the alternative scenario since the pipeline would be longer. The volume of oil released if the entire pipeline volume were lost would be 30,000 bbl.

Table 4.1-17
Summary of Worst Case Shoreline Fate for Individual Terminal Spills
Berth Relocation Alternatives

Scenario Name	Alternative Shoreline Length - Mainland, miles (km)	Alternative Shoreline Length – Islands, miles (km)
Lightly Soiled[a], more than 100 g/m^2 [b]		
Diesel; 30,000 bbl	25.1 (41.9)	79.3 (132.2)
Light crude; 30,000 bbl	22.3 (37.1)	49.2 (82)
Heavy crude; 30,000 bbl	21.4 (35.6)	44 (73.4)
Heavily Soiled, more than 1,000 g/m^2		
Diesel; 30,000 bbl	4.8 (8)	10.2 (16.9)
Light crude; 30,000 bbl	15.3 (25.5)	38.3 (63.9)
Heavy crude; 30,000 bbl	15.7 (26.1)	34.9 (58.2)

Notes: a Lightly soiled equates to the threshold for intertidal impacts. See Appendix C.
b m^2 = square meters

With the berth located farther offshore, there would be additional time to respond to a spill before it impacted the mainland shoreline of Santa Monica Bay (given the same spill scenario, ocean currents and meteorological conditions). Modeling indicates that an additional five hours, under average wind conditions, would be gained under this alternative before a spill would begin impacting the mainland shoreline (see Appendix C).

However, since lightering related to the Marine Terminal operations would no longer occur under this alternative, spills from VLCC tankers could now occur at the Marine Terminal, closer to shore. Unloading larger VLCC tankers closer to shore would increase the severity of oil spill impacts for all areas since potential spill sizes would be greater than under current operations or the proposed Project.

In terms of spill frequency, this alternative would decrease vessel traffic at the Marine Terminal because the Marine Terminal could accept VLCC tankers and therefore eliminate the additional lightering vessels that visit the Marine Terminal. Table 4.1-18 shows the reduction in spill frequencies and time between spills.

Spill risks associated with lightering offshore the California coast would still exist due to other operators or other terminal requirements. However, spill risks due to Marine Terminal-related lightering would be eliminated.

Spill risks due to hose operations would remain the same as the current operations since the number of hoses would remain the same.

Table 4.1-18
Marine Terminal Future Operations Spill Frequencies
Alternatives

	Berth Relocation Alternatives			Pier 400 Alternative		
	Annual Spill Rate, spills per 1,000 vessel calls	**Annual Frequency, spills per year**	**Time Between Spills**	**Annual Spill Rate, spills per 1,000 vessel calls**	**Annual Frequency, spills per year**	**Time Between Spills**
USCG Spill Rates						
Any Size	9.1	4.1	2.9 months	9.1	3.8	3.1 months
Less than 1,000 gal (24 bbl)	8.44	3.8	3.1 months	8.44	3.6	3.4 months
More than 1,000 gal (24 bbl)	0.69	0.3	3.2 years	0.69	0.3	3.4 years
More than 50,000 gal (1,190 bbl) bbl	0.14	0.06	16.2 years	0.14	0.06	17.5 years
Marine Terminal Historical Spill Rates						
Spill, any size	8.50	3.6	3.4 months	8.50	3.0	4 months
Less than 1,000 gal (24 bbl)	8.00	3.3	3.6 months	8.00	2.8	4.2 months
More than 1,000 gal (24 bbl)	0.41	0.2	5.8 years	0.41	0.1	6.9 years
More than 50,000 gal (1,190 bbl) bbl	0.14	0.1	17.1 years	0.14	0.0	20.1 years
Pipelines (spill rate in spills per mile-year for pipelines or spills per year for hoses)						
Pipelines, spill any size	0.023	0.28	4.4	0.025	0.22	4.5
Pipelines, more than 2,100 gal (50 bbl)	0.004	0.04	24.5	0.004	0.04	25.0

Lengthening the pipeline to the reach the more distant berth would cause a small increase in the frequency of spills due to the increased pipeline length. However, the spill frequency from the new, extended portion of the pipeline would be low as the pipeline would be a new pipeline.

Impact **SSR-1** would be reduced under this alternative because fewer vessels would call at the Marine Terminal. **MM SSR-1a** and **SSR-1b** would still apply.

Impact **SSR-2** would have lower spill frequencies but more severe consequences for the worst-case spill scenario (as previously discussed). **MM SSR-2a** through **SSR-2k** would still be implemented.

Under this alternative, Impact **SSR-3** would increase since additional pipeline installation would be required to extend Berth 4 farther into the ocean. Impacts associated with maintenance would remain the same as with the proposed Project. **MM SSR-3** identified for the proposed Project would apply.

Impacts related to spill response, would be similar to the proposed Project, except that larger vessels (VLCC) would visit the Marine Terminal, which could result in larger worst-case spills. The CDFG OSPR has developed best available protection standards for shorelines and response capabilities. The Los Angeles/Long Beach Area Contingency Planning document indicates that, for planning purposes, the worst-case discharge would be from a VLCC tanker close to shore and that sufficient resources exist to respond to this scenario (OSPR 2008). Since the response capabilities of the area are sufficient to address a worst-case spill from VLCC tankers at the Marine Terminal, impacts would remain less than significant (Class III).

SPM Replacement in State Waters for Crude Only

The single point mooring (SPM) alternative would move the crude oil Berth 4 to a location farther offshore in state waters and install a single-point mooring system to allow for the unloading of vessels, including VLCC-sized vessels, at the Marine Terminal.

The single point mooring alternative would have similar impacts as the CBM alternative discussed above. The placement of the berth in deeper waters would allow the VLCC vessels to skip lightering and offload directly at the Marine Terminal. This would reduce the number of vessel calls, reducing spill frequency over the proposed Project (see the CBM alternative data in Table 4.1-18). However, unloading larger, VLCC tankers closer to shore would increase the consequences of a worst-case spill scenario.

The USCG studies indicate that deepwater ports are the least environmentally risky mode of crude oil import compared to direct vessel unloading (unloading in ports), offshore lightering (unloading into smaller vessels offshore then again at ports), and offshore moorings (unloading at moorings close to shore, like the Marine Terminal) (USCG 1993, Salancy 1994). This conclusion was based on lower vessel traffic levels associated with deepwater ports far offshore (more than six miles [9.7 km]), which result in a lower rate of transit casualties with other vessels or groundings, and the less severe impacts of spills farther from land, where spills would have more time to dissipate before impacting shorelines.

Spill impacts would be the same as with the CBM alternative, where modeling indicates reduced spill impacts to the mainland shoreline but increased impacts to the Santa Barbara Channel Islands for the same sized vessel. However, unloading the larger VLCC tankers closer to shore would increase the severity of oil spill impacts for all areas for the worst-case spills scenario due to the larger volumes of oil carried by VLCC.

The SPM systems are generally considered more protective of vessels in challenging seas and weather conditions since vessels can rotate around the mooring to better handle adverse conditions. However, since the SPM system would only be a relatively short distance farther offshore, seas and weather would not be substantially different than conditions at the existing Marine Terminal site. The advantages mentioned in the USCG study related to reduced vessel casualties (from vessel collisions or grounds) and reduced spill impacts from smaller spills, due to the distance from land, would also not apply since the system would be similarly distant from shore as the current Marine Terminal moorings (USCG 1993). Therefore, the spill rate associated with the SPM location is considered to be the same as those at a CBM.

The longer and larger pipelines to the Marine Terminal would contribute to some increase in spill potential (see table 4.1-18).

Compared to the proposed Project, spill risks associated with Marine Terminal related lightering offshore the California coast would be eliminated since no lightering associated with Marine Terminal operations would take place under this alternative. However, lightering associated with other terminals' operations in the region would conceivably continue.

Spill risks due to hose operations would be similar to those associated with current operations since the number of hoses would remain the same. A study related to SPM in California indicated that the frequency of failures due to hoses could increase with SPM since as much as 1,000 feet (304.8 m) of hose would float on the water surface (Salancy 1994). However, the study also assumed water depths of 1,000 feet (304.8 m). However, with the SPM in this alternative, water depths would only range to 130 feet (39.6 m), which would still allow the hose to be placed on the ocean floor and retrieved when a vessel is unloading. This would be essentially the same equipment arrangement as with the current Marine Terminal hoses and consequently the failure rates would be the same.

Impact **SSR-1** would be reduced as part of this alternative since fewer vessels would call at the Marine Terminal. **MM SSR-1a** and **SSR-1b** would still apply.

Impact **SSR-2** would have lower spill frequencies but more severe consequences for the worst-case spill scenario. **MM SSR-2a** through **SSR-2k** would still apply.

With this alternative, Impact **SSR-3** and associated **MM SSR-3** identified for the proposed Project would remain the same.

Impacts related to spill response would be similar to the impact associated with the proposed Project, except that larger vessels (VLCC) would visit the Marine Terminal, which could result in larger, worst-case spill sizes. However, the Los Angeles/Long Beach Area Contingency Planning document indicates that response resources are sufficient to handle a spill from a VLCC tanker (OSPR 2008).

VLCC Use of Pier 400

The VLCC Use of Pier 400 alternative would direct all light crude oil, currently lightered from VLCC tankers and unloaded at the Marine Terminal, to the proposed Pier 400 facility in the POLA. The crude oil would be unloaded in the POLA and transported by existing pipelines to the Chevron El Segundo Refinery. Some modifications to the existing pipeline system would be necessary to allow the crude oil to be transported to the Refinery. Diesel and heavy crude would still be unloaded and product loaded at the Marine Terminal as with the proposed Project.

Spill consequences from operations at the Marine Terminal would remain the same as under the proposed Project since the same sized vessels would still be loading and unloading at the Marine Terminal.

Spill consequences within the POLA would be less than the spill consequences at the Marine Terminal. The POLA is an established facility with existing emergency response capabilities. Although spills within the POLA would still generate significant impacts, spills would be less severe than spills at the Marine Terminal since all vessels are required to be completely boomed when loading and unloading in the POLA. Therefore, spills would be contained within boomed areas within the port. Vessel spills could still occur while outside of the ports while vessels are in transit. However, using enclosed ports would reduce the spill consequences for biology to less than those associated with the current, open-water Marine Terminal. See Section 5.0, Socioeconomics, for a discussion of spill impacts that may lead to port closures.

Spill consequences would increase along pipeline rights-of-way that transport crude oil from the ports to the Refinery.

Spill frequencies would be reduced at the Marine Terminal due to fewer vessel calls since lightering vessels associated with VLCC would no longer call at the Marine Terminal (see Table 4.1-18). However, spill frequencies would increase in the POLA associated with increased vessel traffic and unloading operations.

Spill frequency associated with the pipeline transport from the POLA to the Refinery would not increase if the pipelines are currently in use. If the pipelines are currently idle, then there would be an increase in spill frequency along the pipeline routes since the current idle pipelines would be put into use.

Impact **SSR-1** would still be relevant and a slightly more severe threat to public safety and populated areas due to pipeline transportation of crude oil, although fewer vessels would call at the Marine Terminal. **MM SSR-1a** and **SSR-1b** would still apply.

Impact **SSR-2** would be less severe than under the proposed Project. The POLA/POLB already requires many of the mitigation measures associated with Impact **SSR-2**. **MM SSR-2a** through **SSR-d**, **SSR-2f** through **SSR-h,** and **SSR-2j** would not apply to vessels calling at the POLA/POLB but would apply to vessels calling at the Marine Terminal. **MM SSR-2e** and **SSR-2i** would still apply. Table 4.1-18 shows that the estimated frequency of spills at the Marine Terminal would be lowest under this alternative, since this alternative would reduce the number of vessel calls to the Marine Terminal.

With this alternative, Impact **SSR-3** and associated **MM SSR-3** identified for the proposed Project would remain the same.

Impacts related to spill response would be similar to the proposed Project, with the same-size vessels visiting the Marine Terminal. Spill response capabilities at the

POLA/POLB address spills within the size range of the Area Contingency Plan and would therefore be considered less than significant.

4.1.6 Cumulative Projects Impact Analysis

The number of accidents involving tankers and barges is roughly a function of the number of nautical miles traveled by loaded vessels and the number of port calls. However, the probability of an accident for a specific area increases if the area becomes overly congested.

The projected increase in traffic at the Marine Terminal through 2040, as described in Section 2.0, Project Description, would increase regional vessel traffic by approximately 2.6 percent (based on 2006 POLA/POLB commercial vessel traffic). This is less than the vessel traffic increase to the POLA/POLB between 2002 and 2004. This is a relatively small increase and would not noticeably change the area spill rate due to increased congestion. Furthermore, since there are no other marine terminals near the Marine Terminal in Santa Monica Bay, no cumulative impacts would occur from congestion of combined vessel traffic to and from the Marine Terminal and other terminals. Thus, cumulative impacts to safety are not considered to be significant.

In contrast, the Pier 400 Project is estimated to generate as many as 201 vessel calls per year by 2025 (POLA 2008). This would increase vessel traffic at the POLA/POLB approximately 3.8 percent; however, this does not account for the potential reduction in vessel traffic due to the use of large VLCC tankers by the Pier 400 Project. Regardless, this would not produce a cumulative impact since this would still be within the range of historic vessel traffic at the POLA/POLB, which has been handled successfully.

If a spill were to occur within or near the POLA/POLB, a portion of the ports could be shut down, as was the case in 1991 following the *Sammi Superstars incident*. Vessels may have to anchor offshore, which could increase congestion during the port shutdown, which in turn could increase the possibility of collisions and subsequent spills. However, most likely, provisions would be put in place to ensure traffic conditions do not become hazardous, either near the ports or near the Marine Terminal.

No significant cumulative impacts from hazardous materials are anticipated because no other sediment-disturbing activities would occur in the vicinity of the existing pipelines that could lead to cumulative effects.